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ABSTRACT

A multidisciplinary analysis of education in the USSR is used to clarify the overall working of the educational process by highlighting one of its essential components--teaching methods. These methods are considered from the standpoint of the dialectic which brings together teaching and learning and underlies the teacher/pupil relationship. In the Soviet system, this synthesis is compatible with the broad goal of the communist upbringing of students through education. Chapter topics are: (1) essence and definition of teaching methods; (2) historical background; (3) teaching methods compared with other educational concepts; (4) psychological background; (5) functions of teaching methods; (6) classification of teaching methods; (7) systems of teaching methods and techniques; (8) methods of teaching by problem orientation; (9) variety and specificity of teaching methods; (10) interdisciplinary teaching methods; (11) selection and combination of teaching methods; and (12) teachers' contributions to methodology. A glossary of educational terms is appended. (JD)

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Teaching methods in the Soviet school

I. D. Zverev

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Preface

In presenting Professor Ivan D. Zverev's study on teaching methods in the Soviet school, the IBE would like to stress the special place occupied by this monograph – as well, incidentally, as a second one, by Dr. Kraevskij and Professor Lerner, on the content of education in the USSR, to be published shortly – in the Bureau's programme devoted to the educational sciences.

Some readers might perhaps have expected the Soviet specialists to contribute to this programme distinct monographs on certain educational sciences or major themes – in the framework of one particular science or another. Instead of this, we have here two overall studies bearing on Soviet educational reality taken as a whole. This stems from the interest shown, even during the Second World War, by Soviet leaders in all aspects of educational research, interest which led to the setting up in 1943 of the Academy of Pedagogical Sciences, of which Professor I.D. Zverev is at present Vice-President and thanks to which educational research was immediately perceived as a whole.

With practical objectives in line with a clearly defined educational policy, educational research as conducted by the Academy of Pedagogical Sciences and its network of institutes in the various republics was bound to be multidisciplinary research in which an analytical approach implies an overall presentation of the educational process drawn from methods, foundations, applications and problems on all the educational sciences combined: all this with a view to the continual improvement of the education system which is designed to train a certain type of person, who is himself defined in relation to a certain design for society. Thus the Soviet contribution to the IBE educational sciences programme cannot be expected to take the form of separate monographs on the disciplines which go to make up what, in the USSR, are called the pedagogical sciences. For the value of each one can only be expressed in relation to the whole, if all are to contribute to the constant improvement of the educational process.

In selecting the subject of this monograph, Professor Zverev has sought – with outstanding success – to show how it is possible, by means of a multidisciplinary analysis, to make clear the overall working of the educational process by highlighting one of its essential components – teaching methods. It is true that these methods are considered from the standpoint of the dialectic which brings together teaching and learning and which underlies the teacher/pupil relationship: this makes for a dynamic and synthetic approach to the education system. It is also worth pointing out – for this is not always obvious – that in the Soviet system this synthesis

concerns both teaching and education for, as the author himself so rightly stresses 'it is impossible to teach without training for upbringing'.

Let there be no misunderstanding with regard to the character of this monograph: it is far from being a mere survey of teaching methods in use in the Soviet education system. For, as the author himself says, 'Teaching methods taken separately cannot be demonstrated to fulfil educational, behavioural and developmental functions. It appears more logical to perceive their common function thus embracing the educative process as a whole rather than try to interpret it piece by piece.'

In renewing our thanks to Professor I.D. Zverev for his invaluable collaboration with the IBE educational sciences programme, and in the conviction that this contribution will not fail to arouse wide interest, we would point out that the ideas and opinions expressed in this work are those of the author and do not necessarily reflect those of Unesco. Similarly, the designations employed and the presentation of material throughout the publication do not imply the expression of any opinion whatsoever on the part of Unesco concerning the legal status of any country or territory or of its authorities, or concerning the delimitations of any country or territory.

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Introduction

One can approach the description of teaching methods by reducing the problem to a few simple questions: 'What to teach for?' (object); 'What to teach?' (subject); 'How to teach and what with?' (method). This outwardly simplistic formula has nevertheless remained a favourite one with educationists everywhere from the very inception of educational theory, and not only for its simplicity but for its comprehensiveness as well. Indeed, besides being related, the above questions manifest linkages with the whole process of education and, implicitly, with its end product. By following this line of reasoning, it should be possible to visualize the manifold components of a concept of teaching methods in interaction with other parts of the education system rather than in isolation. Lenin, for one, insists that all the interconnected components of any phenomenon under scrutiny be assessed as a whole, rejecting a fragmentary approach[1].

The fact that a schoolteacher finds it virtually impossible to deal separately with scores of phenomena he encounters in his day-to-day scholastic routine seems to bear out another of Lenin's arguments about particulars being (if not in essence, at least in part) universals and vice-versa[2]. Soviet educators have sought to bring over Lenin's integral approach of analysing a phenomenon into the field of educational theory. Thus they would regard teaching methods as but one element in the whole process of education. It is from this stance that the present discourse sets out to examine the totality of teaching methods, and to interpret and define them. It will be recalled that one can judge the progress of a science by the extent and depth to which it is capable of interpreting an idea, the linkages of that idea with general philosophy and day-to-day realities.

Now that the concept of teaching methods has been given a somewhat philosophical background, it may be advisable to turn to the philosophy underlying the development of teaching methods for the Soviet school and Soviet educational theory in general. The experience of Soviet educationists is unique and far from uniform: the various decisions on teaching methods taken at different times, along with certain successes, brought about problems and led to some exaggerated practices. In overcoming negative phenomena in the field of educational theory, Soviet educationists draw upon Marxism-Leninism for theoretical guidance and upon the schoolteacher's daily experience for practical solutions. By employing the above-mentioned integral approach they are certainly better equipped to determine a proper place for the theory of teaching vis-à-vis other aspects of education.

It would appear irrational to try to examine teaching methods without taking psychology into consideration, a science most intimately associated with teaching. The concept 'teaching methods' is susceptible of definitions in terms of psychology

as well as in a purely educational context. Thus, the psychology of learning is essential to the supervision of learning, which is simply unimaginable without recourse to the findings of psychology to underpin a solution to the problem of how to teach. Based on the universal theory of education and the data of psychology, educational theory seeks to define the functions of teaching methods in all their many-sided complexity. Stress is placed on the indivisibility of teaching (the teacher's activity) and learning (the pupil's activity). The educational process is further complicated by being a joint procedure with the object and subject of education on the one side and teacher/pupil interaction on the other. And all this, in turn, presupposes the complexity and variety of teaching methods, which can be developed, using the theory of teaching, into highly sophisticated and ramified methodological systems with a high degree of versatility and flexibility resulting from a continuous incorporation of new teaching techniques.

There is an obvious difference between, shall we say, the methods to teach mathematics and music, physical culture and literature, drawing and chemistry, etc. In short, one should have at least a rudimentary notion of the ways in which methods to teach different subjects differ without overlooking that which is consistent and common in teaching methods, that which forms part of the universal content of education. The truly infinite multiplicity of teaching methods not only serves to complicate their classification, but also the more down-to-earth task of their selection with a view to practise. For all that, the selection of an optimum method remains a distinct possibility, provided each method selected for a definite subject is to be used in a logically justifiable combination with other methods, instead of being regarded as an absolute.

The above line of reasoning (interpreted in a very liberal manner) may be suggested as a general guideline to follow in examining the theory of teaching methods. It is incumbent upon the author of the present work to demonstrate, at least by citing examples, the feedback arising between theory and the teacher's activity, since the proper place for teaching methods to evolve is in the classroom and it is left entirely to the teacher's discretion to apply the already existing teaching methods in his own and often more effective ways. The methods arising and developing through the actual process of teaching are as original and unique as the personalities of those teachers and pupils who create and improve them, and as the conditions and work-style prevailing in each school. A solution to its internal problems is especially vital to the modern school, which is functioning in a period of social, technological and scientific revolution, when every school boy and girl stands a reasonable chance of creative fulfilment, of growing up to be worthy and socially active citizens sharing in the ideals of peace, justice and solidarity among those who work.

The USSR's first minister of public education, Anatole Lunačarskij, once emphasized the crucial significance of teaching methods in these words, still valid today[3]:

> Depending on the teaching method in use, the child may feel bored, the instructional material scarcely touching his mind and not leaving so much as a trace, or on the contrary, he may acquire knowledge with gusto, the way he would play and behave out of class, the material he is learning in class becoming an integral part of him, something he would perceive as his own. Depending on the teaching method in use, the class may look upon learning as drudgery and

choose to counter this drudgery with mischief-making or, on the contrary, the pupils may have so much fun learning as to become a member in the team of the teacher's good and respectful friends.

For all practical purposes, one finds it hard to draw a dividing line between education and upbringing in this day and age, the distinction becoming increasingly academic. Besides, upbringing, even to a greater degree than education, has to rely upon the knowledge of child psychology, while remaining as open as ever to even the most avant-garde in the field of methodology.

Following this introduction, I intend to examine the problems raised on the basis of literature and personal experiences in schools.

REFERENCES

1. Lenin, V.I. *Polnoe sobranie sočinenij.* Moskva, Gospolitizdat, 1949. t. 32, p. 69.
2. Ibid., t. 38, p. 59.
3. Lunačarskij, A.V. *O vospitanii i obrazovanii.* Pod. red. A.M. Arsen'eva i dr. Moskva, Pedagogika, 1976, p. 394.

CHAPTER ONE

Essence and definition

An inventory of teaching methods is a complicated matter, and the many facets deserve most careful scrutiny, even though they may appear as just so many self-evident, trivial manifestations of the educational process. Since a method, as we have already said, presupposes a multitude of ramifications of the teaching techniques recommended therein, implicitly answering the question of how to teach, the list simply cannot be exclusive. Here are some examples of how method-generated teaching techniques produce ramifications. Teaching-to-read techniques would typically involve having a text spelled out, pronouncing it syllable-by-syllable or learning it word-by-word, either by means of analysis or synthesis. Events in history may be presented in class either in cut-and-dried form or learned by the pupils through their own unsupervised research. Athletic skills may be acquired by following an oral explanation, a visual demonstration or by viewing an appropriate diagram or film. Learning a piece of literature would normally consist in getting the pupils to reproduce the text to be subsequently analysed and made familiar to them, with the teacher pointing out aesthetic, moral and socio-historic aspects; only after that would the children review the text on their own. Vocational training would successively involve oral presentation, visual demonstration, interpreting the working drawings, carrying out the assigned piece of work, and inspecting it for quality. Teaching music presupposes hearing, playing, comparing the piece to be learned with others, initiation into musical criticism, reproduction of the piece in question, and encouraging the pupils to create on their own. A chemistry or biology lesson would typically consist of experiments staged in the laboratory, films shown in the classroom, and/or diagrams drawn on the blackboard. Quite often all these techniques are combined for greater effect.

One could give more examples of *how* the teacher is teaching, the pupil is learning, and what techniques are used in each particular setting, but the examples furnished so far are perhaps already sufficient evidence of a wide diversity of teaching techniques. And yet, for all their diversity, teaching techniques can be epitomized as a set of teacher/pupil co-ordinated and interconnected activities in class. The teacher asks and the pupils answer. The teacher either begins by taking up with the pupils some generalization and through its analysis leads them on to particular facts or, vice-versa, he discusses with the pupils particular facts first, compares these facts with one another thus leading the pupils on to a generalization. Each particular technique, each particular method, will achieve its purpose only if it is expressly designed to do so, this purpose-serving quality being of crucial significance in solving the problem of how to teach and by what method.

The examples serving to illustrate the diversity of the catalogue of teaching methods also point to the fact that this list is far from easily defined. According to Lenin, 'There can be many definitions, for objects have many aspects'[1]; yet, however numerous, these definitions are not enough to adequately reflect all the intra- and interconnections therein.

The word 'method' has also universal, abstract connotations. Thus, in philosophy the dialectical method is contrasted with the metaphysical; the former seeking to examine a phenomenon in development, its interlinkages and its unity of contradictory motivations; the latter giving a distorted image of the objective reality by examining one phenomenon in isolation from another without due regard to the dynamics of and stages in quality transformations in a given process (natural, social, psychical or educative). The present work is based on the dialectical method in its most universal interpretation (as a way to achieve an aim, as an activity rationalized in a definite manner[2].

In the appropriate article in the 'Grand Soviet Encyclopaedia', interest focuses upon the generic role of a method governing some practical activity. And indeed, the prevailing school of thought among Soviet philosophers would emphasize the role of method not merely as an impersonal recorder of that which exists in objective reality, but rather as a pointer to the rationale of the techniques one is likely to use in the process of cognition or practical activity[3]. The aim of the present work is not so much to lay down an exhaustive and final definition of teaching methods, as to sum up what has already been done by the Soviet educationists in an effort to define them. Leaving aside negligible disparities and omissions in the existing definitions and qualitative assessments of teaching methods, it seems appropriate to single out primary, generic characteristics and specific, secondary-to-generic characteristics. Confusion and controversy commonly arise from the ambiguity of terms used in the existing definitions such as techniques, ways, means, activities, types, forms, etc. Among educationists, these terms may acquire somewhat specific connotations in such combinations as, for instance, 'means of visualization', 'forms of organization of educational activity', 'specific activities', etc. At the same time, it stands to reason to include the concept under discussion into a larger inventory of purpose-serving activities to be subdivided into a regular array of techniques and actions. Such techniques and actions may acquire the character of various external and internal purpose-oriented teacher/pupil activities. Commonly, the existing definitions of teaching methods go into too much detail about the purposes they are meant to serve, which, for instance, are indicated as 'learning the content of curriculum', 'conscious acquisition of material', 'acquiring skills and study habits', 'formation of outlook', etc. It seems unwarranted to encumber a definition (of necessity brief) with a detailed inventory of the purposes of teaching methods. It would be much more relevant in this particular instance to adopt a generalized mode of definition.

The secondary, specific characteristics of teaching methods come under scrutiny in the writings of such Soviet educationists as Aleksjuk, Babanskij, Lerner and Skatkin [4, 5 and 6], to mention just a few. First and foremost, these characteristics manifest themselves as a means (form) to express the content of education. It will be recalled that Hegel defined method in philosophy as a form of content-motion. And indeed, it is through a dynamic process of teaching and through logical structures

that the teacher, and after him the pupils, are expressing (manifesting) the knowledge, skills and study habits they are teaching and learning (by deduction, induction, synthesis, analysis, summary, consolidation, comparison, classification, etc.).

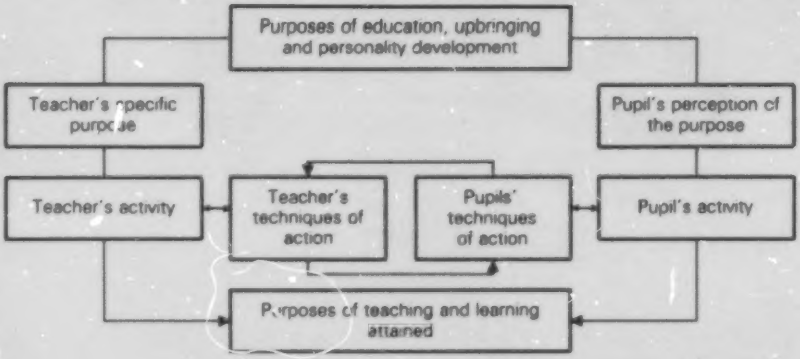
All these and similar logical structures make up the essence of method – its content. A method would typically specify a level of learning activity and of originality in creative reasoning. Thus, knowledge can be merely reproduced by pupils receiving it as a finished product from the teacher or, on the contrary, a method may prescribe that pupils do the retrieval of knowledge themselves through a set of consistent, logical arguments, or again one may keep asking the pupils leading questions (heuristic dialogue) until they arrive at the sought-for conclusion, or, finally, the pupils may be given a chance to make a 'scientific discovery' on condition that they stick to the rules of the experiment they are assigned to conduct. A method presupposes outwardly expressed forms as a medium for the teacher/pupil feedback involving communication (speech), imagery (visualization) and operation (action). Teaching methods are means to direct learning-cognition activity or for it to direct itself, to be organized, stimulated and motivated. They are means to direct the entire cognitive process from setting the problem to confirming the solution. All the above characteristics of teaching methods make them a complex entity to supervise, not only education in the sense of acquiring a certain amount of knowledge, skills and study habits, and attaining a certain degree of intellectual, emotional and behavioural development, but also education in the sense of communicating a set of convictions, responses, and behaviour and activity patterns. Personality development and upbringing go hand-in-hand with education. In this perspective, teaching methods appear to be definable as an *orderly set of techniques (operations) used in the process of teacher/pupil interaction and serving the purposes of personality development and education.* In this definition stress is laid upon the activity-oriented character of teaching methods involving teacher/pupil feedback (pupils' initiative), since, as we have already said, the educational process consists not only of teaching (the teacher's activity), but also of learning (the pupils' activity).

To limit the definition to a 'set of consistent operations performed by the teacher' – a formula sometimes adopted in manuals for teacher training colleges – would amount to ignoring the teacher/pupil interaction idea and, by implication, the dual character of the teaching methods' concept. Figure 1 presents the essence of this concept:

The activities of both the teacher and the pupils (manifested as actions) are closely interconnected with the result that the teacher modifies his activities in accordance with the expediences of learning. Thus, on the one hand, the expediences of learning are a determining factor in teaching, and, on the other, it is the teacher who determines the conduct of learning in that he governs the pupils' actions.

Definitions of teaching methods contain their main characteristics, whereas, in a particular situation in teaching, stress may be laid upon a single characteristic, such as cognitive, logical, governing, etc. A teaching method may serve to impart knowledge, scientific data (e.g. oral method), provide a logical package for content (e.g. summarizing method), emphasize the evaluation of learning function (e.g. written-test method), and specify the cognitive-activity level (e.g. problem-oriented method). Thus, a teaching method would typically comprise an *external* aspect of

FIGURE 1. The teaching methods' concept


Purposes of education, upbringing and personality development
Teacher's specific purpose
Pupil's perception of the purpose
Teacher's activity
Teacher's techniques of action
Pupils' techniques of action
Pupil's activity
Purposes of teaching and learning attained

the educational process which is associated with the use of sources of knowledge and with forms to direct learning, and an *internal* aspect which is associated with the logical, psychological operations of the teacher and pupils. The distinction between the external and internal aspects of teaching method was also noted by Ušinski, a celebrated Russian educator of the nineteenth century, and many others in subsequent years. According to Krupskaja, a reputed public educator, an adequate answer to the question of how to teach presupposes the creation of techniques for the teacher to impart knowledge and supervise learning, and for the pupils to learn. Upon closer scrutiny, teaching methods appear to be similar to philosophical methods to understand the laws which govern progression from the external to the internal, from phenomenon to essence. At the same time, it appears unreasonable to discard the formal package of teaching methods, as far as definition goes, since in any phenomenon form derives from content and neither a phenomenon nor a thing can be imagined without the former or the latter.

Certain educationists, proceeding from a Hegelian argument about the external form being 'indifferent' to content, have tended to ignore the form the teaching methods acquire. At the same time, form and content do not necessarily correspond (e.g. dialogue as form may follow either a dogmatic or a heuristic pattern). Naturally, the educationist should be concerned with the form the content of methods acquires. In educational theory, interest tends to shift away from the external aspect of methods to the internal, not however to the exclusion of the former. On the one hand, the external aspect makes up the logical package of scientific content and, on the other, it manifests itself in the logical operations the pupils use in learning that content, operations introduced for this purpose by the teacher into the educational process. The acquisition by a pupil of logical operations is a major prerequisite to the development in the pupil of cognitive self-reliance and creative ability. It is just another proof of the linkages between logic and psychology in teaching methods. The essence of teaching methods is revealed in terms of educational theory by having recourse to psychological data on the role of the transfer of operations in the acquisition of knowledge, skills and study habits, as well as the patterns of their

post-transfer application, whether in transient, systematic or more complicated learning situations. The pupils' acquisition of instructional material is largely determined by their cognitive ability for structuralization specified in the given method (motivation to learn, problem-orientation, the formulation of working methods, the evaluation of knowledge acquisition, and testing).

The preceding discussion of major aspects of teaching methods should facilitate their many-sided, in-depth analysis, provided due heed is paid to the schoolteacher's day-to-day experience.

Since teaching methods have a long history of keeping pace with school development, they should be analysed, at least in part, both in terms of theory and 'field' experience.

REFERENCES

1. Lenin, V.I. *Collected works. Vol. 38: Philosophical notebooks.* Moscow, Foreign Languages Publishing House, 1963, p. 235.
2. *Filosofskij slovar'.* Pod. red. Rozentalja i Judina. Moskva, 1963.
3. *Logika naučnogo poznanija.* 1965, p. 305.
4. Aleksjuk, A.N. *Zagal'ni metodi navčannja v školi.* 1981. [In Ukrainian]
5. Babanskij, Ju.K., ed. *Vybor metodov obučenija.* 1982.
6. Danilov, M.A.; Skatkin, M.N., eds. *Didaktika srednej školy: nekotorye problemy sovremennoj didaktiki.* Moskva, Prosveščenie, 1975. 304 p.

CHAPTER TWO

Historical background

Teaching methods have altered with the changing socio-historic conditions influencing the development of the school, and modifications in the goals and content of formal education. As for any other activities in the education system, they are also a social sector subject to change and development. This change is a complicated and controversial process, since, more often than not, there arises a lag between what is officially required of the educators of the younger generations and the expediences of social progress.

In historical terms, the development of educational thinking and public instruction in pre-revolutionary Russia was subject to western influences which were manifest in day-to-day scholastic life and, notably, in teaching methods. Doctrinaire, dry-as-dust teaching methods were quite common in the past and not only in the Russian school. These teaching traditions were at least partly inherited by the Soviet school. The lifeless instruction and cramming were, however, largely overcome already at the dawn of Soviet schooling. Tsarist Russia's notorious public instruction system, with its incessant drilling, rote-learning methods and compulsory study of the Orthodox religious doctrine, bore the unmistakable stamp of feudalism, even though already before the Revolution there had been attempts to establish a rapport between the school and day-to-day realities. For decades nothing had changed in the curricula of parish/church elementary schools where all that the peasant children were offered was learning to read, write and do arithmetical problems, with religion being the key subject and its dogmas being memorized without any regard for comprehension. Also memorized in the same uncritical spirit were moralistic tales of the catechism, invariably supplied with an equally moralistic and one-sided commentary.

However, since the inception of popular schools in 1804, the latter's curriculum already recommended learning the basic facts about the country, its peoples and its landscape. The country needed the services of literate and enterprising men. Accordingly, reading from a textbook and the teacher's monologues were now complemented by the pupil's own comments, debates on works of art, observations of natural objects like minerals and plants, and by learning the use of tables and diagrams.

This innovative approach was exemplified in the publication by Zueff of Russia's first textbook with illustrations[1]. A no mean influence on Russian formal education was exerted by Komenskij, an eminent educator of the epoch. The British-originated Lancaster teaching method had by that time also gained some ground in Russia.

With the advent of capitalism in the country in the second half of the nineteenth century, educational thinking received a new boost – the existing network of educational institutions was expanded. Scientific and technological progress stimulated the progress of the two prevalent types of school: the gymnasia and the technical school. As far back as 1863, the study of natural history, not only at university but also at school level, was already influenced by Darwinistic concepts which presupposed the introduction of an actively analytical approach, comparison and definition.

It was the heyday of men like Ušinskij with his novel teaching approach. Having made a careful study of German and Swiss educational experience, the famous educator saw the period as opportune for dropping the torpid, hopelessly outdated procedure of imparting knowledge along the lines of classroom authoritarianism. He did his utmost to devise optimum methods to inculcate in the pupils, at an early age, lofty morals, and to motivate them to acquire through education a broad and honest view of the world. His methods went beyond offering the pupil knowledge in a cut-and-dried form and then having him reproduce it.

The experience of progressive schoolteachers, and especially Ušinskij's exemplary teaching performance at the Smolni Institute for the daughters of nobility, proved to be a major contribution in the development of methods to galvanize the pupils' cognitive activity, even though the progressive educators had to work in the climate of retrograde methodology imposed upon them by just as retrograde an officialdom of the tsarist public instruction ministry. Truly archaic methods relying on cramming were more typical of the classic gymnasia which were biased in favour of humanities and languages, whilst the technical schools were striving to better equip the prospective school-leavers to face the realities of post-school adaptation and therefore were more receptive to the introduction of visual aids, practical periods, laboratory techniques, research-oriented excursions, observations and experiments. Already in the 1860s, the head of St. Petersburg University, A.N. Beketoff, introduced experiments in nature study into the school curriculum.

A major contribution to the preparation of goals, content, techniques and forms of natural history curricula was made by Ušinskij's followers Gerd and Kaptereff. The latter notably emphasized the need to classify and systematize teaching methods. Also enjoying a certain popularity in Russia at that period were the German-originated Leuben method, the Rossmesler method (the German chemist), and the teaching procedure of the German biologist Schmeil. However, all the above methods were used in Russia merely to activate teaching without too much interference with the metaphysical idealistic approach to education, the latter relying almost exclusively on the church, the tsar and tsarist officialdom for ideological guidance.

In the complete jungle of controversial educational concepts prevailing just before the October revolution, one can still draw a dividing line between those favouring the progressive trends of classical teaching and those supporting tsarist absolutism in its bid to stamp out liberal thought in fear of the school exerting any revolutionary influence on society.

Looking back on that epoch, the Soviet educational historians have tended to distinguish four trends: education represented by the ministry of public instruction serving the interests of the supreme monarch and ruling classes; the education of a

liberal bourgeoisie, a class owing its existence to the expediences of Russia's economic development but supporting in principle, the monarchy; the education of an educated petty bourgeoisie and gentry opposed to the authorities; and, finally, the education of the revolutionary working class and toiling peasantry[2]. Revolutionary education, having incorporated the progressive ideas of its Russian and foreign predecessors, has developed into what is now known as Marxist-Leninist education, and we, its adherents, even today derive inspiration from the writings of the Russian revolutionary democrats Herzen, Černyševski and Dobrolyubov, writings which have had a profound influence on the views of their contemporaries in the field of education, Ulyanov, Ušinskij, Bunakov, Vodovozov, and Ostrogorskij. The diversity and complexity of opposing educational concepts in the period preceding the October revolution in Russia must have been largely responsible for a similar clash of creeds immediately after.

Educational theory and classroom activity in the early Soviet period underwent a certain infatuation with the 'teaching-through-active-work' method. This method was developed in the 1920s, when too much was thought of pragmatic teaching, unsupervised education and the value of pupils' personal experiences, and too little of the guiding role of the teacher in the classroom. The teaching-through-active-work method was regarded by Blonskij, Šatski, and their contemporaries, as a means to develop initiative and creativity in the pupils, as a means of their spiritual and physical advancement. It was claimed to be a major contribution to the creation of what was known as the United Working People's School of the Russian Federation.

Other educationists of the day went to the opposite extreme of blindly following school experience in the United States, which meant trying to adapt to altogether different goals. Still others tended to overrate the educational effectiveness of practical training and inductive teaching. Sometimes Soviet educationists in their quest for new methods fell into the error of replacing school subjects with curricular variables based on the 'complex method'. The Soviet school also lived through an infatuation for the 'Dalton plan' and project method. These false starts, dictated by the genuine desire to strengthen the ties of school with day-to-day realities, industrial production, to develop in the pupils business-like qualities and greater independence, at the same time served to undermine formal academic standards. They simply failed to motivate the pupils to acquire basic knowledge.

Thus, in weighing up the project method, Krupskaja, for one, came to the conclusion that it was too permissive, averse to the very idea of systematic study and served to minimize the importance of educational theory in formal education. The benefit to be gained from the visual-instruction procedure, as represented by Lai, Kerschensteiner and Duke, was likewise overestimated. And as for discovery teaching, it appears to come close in many respects to the above-mentioned teaching-through-work method, the adherents of which, it will be remembered, were so carried away with unsupervised teaching as to be virtually unrestrictive. At the time, these methods were boldly stated to compare advantageously with the rigidly pontificating procedure of the pre-revolutionary school[3,4]. Lectures were implacably rejected as hopelessly passive and pedantic, the oral discourse being labelled as a stumbling block to the introduction of activity-fostering methods. At the same time, the idolization of the activity methods to the exclusion of all others made

them too suspect in the eyes of the user who was apt to fall into the opposite extreme of rejecting the basic advantages and the promise of innovative techniques, provided they were used with discretion and in proper combination with time-honoured practices.

The Party and Government decisions of 1931 and 1932 relating to formal education took a negative view of method-for-method's sake attitudes. Declaring a preference for proper development of a system, they rejected as useless the absolutism of any single method.

In subsequent years, the educationists adopted a polyvalent evaluation of method and realised the feasibility of grouping various methods together. Some of the existing methods were further elaborated. This involved the identification of their basic characteristics, which, in turn, provided a basis for method classification. The early 1930s saw a turning point in the improvement of educational content, as well as in teaching methods, techniques and forms. Good progress was made in the development of methods to teach specific subjects, the improvement of textbooks, lesson plans and visual aids, all of which naturally provided a stimulus to the application of a wider variety of classroom techniques. As far as the teacher's presentation goes, these included, among others, narration, description, explanation, demonstration, lecture and dialogue, and as far as teacher/pupil interaction goes, using the textbook, other books, exercises, traditional homework, repetition, laboratory and other demonstration practices, visualization, illustration, research-oriented excursions, etc. The partial return to a traditional approach was necessary to overcome the main drawback of formal education in the 1920s – to make up for the lack of comprehensive knowledge being imparted at school. At the same time, in the decades that followed, Soviet educationists and teachers failed to give enough attention to discovery teaching techniques in the educational process. There was a certain departure from the progress made in the 1930s in the organization of work-oriented teaching, and in the inculcation in the pupils of working skills and habits.

During the Second World War, the school combined its educational efforts with the effort to aid those fighting and working to win the war. Things were especially hard in the occupied and front-line zones. In the beleaguered city of Leningrad, teachers and pupils alike went through the ordeal of starvation and bombings, the teachers giving moral support. Even in these years of hardship, Party and Government leaders were conscious of what the country would need after the war, and were thinking of rehabilitating and developing further the national economy, culture and education. In 1943, when the war was at its height, a decision was taken to establish in the Russian Federation an Academy of Pedagogical Sciences. This was a declaration of faith in the humanitarian role of education as a basis for the people's enlightenment. Gradually the academy became a focal point for educational thought in the country. Under its aegis, discussions have taken place on the content of education, on the salient points of teaching, on lesson conduct, on the essence of the educational process, etc. Thus, Academy Member S.L. Rubinštejn defined problem-oriented teaching which emphasized learning through guided research.

The expediences of post-war economic recovery re-activated the educational process and further strengthened the ties between the school and day-to-day rea-

lities. In collaboration with teachers, these were the guidelines for educationists contributing to the reform of education.

The early 1950s saw the publication of monographs on lesson plans and teaching methods. Educationists Lordkipanidze and Golant made a pioneering attempt at defining oral, graphic and active methods, stressing the need to develop a theory of methods and, particularly, theoretical criteria for the teacher to select and practise.

In the period 1956-58, a debate was conducted on methods in which educationists, psychologists and teachers participated [5,6,7,8]. Interest focused upon the educative, upbringing and developmental functions with special emphasis on the in-depth study of the internal, substantive aspect of method, as well as on the feasibility of identifying universal, non-specific methods (Perovskij). The development of methods theory was considerably enhanced by psychology. A debate on the linkages between child upbringing and child development, attended by such reputed psychologists as Kostjuk, Leont'ev and Menčinskaja, served to emphasize the need for further collaboration of educationists and psychologists. More forcible arguments in favour of greater diversity of pupils' activity, the activization of the educational process, and expansion of learning interests were advanced by Yesipov, Šapovalenko, Skatkin, Ščukina, Danilov and others).

The Soviet teachers of the period proved to be no less innovative and creative than the theorists. Thus, an experiment staged by teachers in and around the town of Lipetsk became a benchmark for Soviet educators. This experiment stressed the intensification of the lesson, its restructuring, the introduction of techniques to motivate the pupils to think, to encourage teacher/pupil feedback and a more detailed assessment of each pupil's contribution to classroom work. The Lipetsk project gave rise to the development of a wide variety of standardized assignments for pupils' unsupervised work for an equally wide variety of subjects. In the Tartar Autonomous Republic, a broad-based experiment was undertaken on discovery teaching which resulted in this method being further improved. Subsequently, the findings were summarized in a doctoral thesis by Mahmutov.

In the above experiments, problem orientation took the form of identifying confrontations, characteristic of scientific research, which fostered learning. The introduction of discovery teaching generated a need for the development and use of other methods.

The theory of methods progressed further through the research of Zankov on the use of various word-and-image patterns, his findings permitting methods to be described from the stance of visualization.

All this greatly contributed to the understanding and practise of teaching methods, and a search for new methods which would serve to achieve the goals which the Soviet school had been set during this period of renovation. It is in this period that the academic, abstract teaching methods of the pre-revolutionary school were finally overcome. Now teaching methods were directed towards bridging the gap between school and daily life, upon teaching the pupil to think for himself, to be more self-reliant, to be more active, to learn the basic facts of science more soundly and in a more analytical way, which is equally applicable to acquiring sound study-and-work skills and habits. In this process of reorientation and improvement, teaching-through-work, graphic, discovery-heuristic and oral methods gai-

ned in depth and viability. Efforts on the part of theorists to come up with a more holistic system of methods seem to bear out the idea advanced by Krupskaja who criticized those attempting to reduce a system of methods to just so many teaching techniques.

Another reform of educational content, which lasted from 1965 to 1976, resulted in remarkable progress in educational theory and formal education, and notably in teaching methods. The country's overall economic progress had by this time permitted the decisive step to compulsory secondary education.

The revised content of education, as reflected in the newly approved curricula and textbooks, called for the updating of teaching methods. Daily classroom experience and the findings of participative research favoured the conclusion that it should be possible for every normal child – within the limits imposed by his individual intellectual capacities – to cope with the minimum of knowledge specified in the curricula. For those children who might wish to go beyond this minimum to develop their individual capacities and interests still further, a wide variety of extra-curricular scientific, technical and cultural subjects was offered for study (about 100 in all).

The information explosion and the unparalleled multitude of sources of knowledge at the disposal of modern schoolchildren make it especially imperative, on the one hand, to eliminate from the curricula and textbooks material that is too complex and purely academic and, on the other, to communicate to the children a way of coming to terms with this torrent of scientific and political information.

The primary considerations in developing teaching methods are the encouragement in every pupil of self-reliance, creative initiative and the curiosity to find out more, as well as the strengthening of ties between study and work. The Soviet school has at its disposal a whole array of heuristic search-promoting methods capable of fostering the pupils' creative initiative while learning. At the same time, one should be admonished against ignoring the teacher's role as the supervisor, organizer and manager of the educational process – as the pupils' guide from ignorance to knowledge.

As far as the evaluation of teacher/pupil interaction and the supervision of each pupil's progress are concerned, the development of teaching methods has to some extent benefited from programmed instruction. For all that, programmed instruction has not gained a mass following in the country, even though some Soviet educationists gave much credence to its educational potential when it first came into vogue. In actual fact, this technique has never gone beyond the use of programmed texts, the rudimentary technical aids available to ordinary schools, and the publication of a few textbooks constructed on the principle of content algorithms.

More relevant to the progress of educational methodology has been the merger of several teaching techniques into a cluster, the resultant clusters including diverse teaching techniques which make up still greater teaching complexes (Šapovalenko). The use of teaching clusters has been co-ordinated with such newly advanced procedures as are expected to meet the present-day formal education requirements, i.e. the arrangement of audio-visual materials in a guided-discovery basis; the setting of cognitive problems; giving the pupils a chance to carry out experiments on

their own; the selection of criteria to optimize the storage of data on practical experiences, etc.

Certainly deserving support is the present-day tendency of methodology to give direction not only to education in the purely instructional sense, but also to upbringing and all-round personality development. This broad-minded approach was initiated by Suhomlinskij and Zankov, two outstanding Soviet educationists.

The evolution of methodology and the practise of teaching methods in Soviet formal education were taken a stage further as a result of a national conference on teaching methods in Leningrad in January 1978, in which the author of the present work played a role. The papers delivered at the conference have been published both as abstracts and also in complete texts[9,10]. The conference summed up the current trends in the definition and classification of teaching methods with due regard to their polyvalence; it reiterated its negative attitude to the undue preference for some methods to the exclusion of others; the conference emphasized the linkages between non-specific and subject-specific categories of methods.

It is the materials of the conference in question and the literature published in the intervening period that have served as a basis for the ensuing discussion on the present-day attempts at conceptualizing teaching methods and, first and foremost, at determining their place among other educational phenomena and categories of phenomena.

REFERENCES

1. Rajkov,B.E. *Puti i sposoby naturalističeskogo prosveščenija.* Moskva, Izsdatel'stvo Akademii pedagogičeskih nauk RSFSR, 1960. 487 p.
2. Aleksjuk, A.N. *Razvitie metodov obučenija v sovetskoj škole.* Kiev, 1972.
3. Vsesvjatskij, B.V. Metod iskanij (issledovatel'skij) i novye programmy. *Na putjah k novoj škole* (Moskva), N° 4–5, 1924, p. 8.
4. Jagodovskij, K.P. *Issledovatel'skij metod v škol'nom obučenii.* Moskva, Gosizdat, 1929. 168 p.
5. Perovskij, E.I. Problema metoda v obučenii. *Sovetskaja pedagogika* (Moskva), g. izd. XX, N° 12, dekabr' 1956, p. 75–90.
6. Golant, E.Ja. K teorii metodov obučenija v sovetskoj škole. *Sovetskaja pedagogika* (Moskva), g. izd. XX, N° 11. nojabr' 1956, p. 90–98.
7. Danilov, M.A. K voprosy o metodah obučenija v sovetskoj škole. *Sovetskaja pedagogika* (Moskva), g. izd. XX, N° 10, oktjabr' 1956, p. 87–101.
8. Sohor, A.M. O metodah obučenija. *Sovetskaja pedagogika* (Moskva), g. izd. XXI, N° 2, febral' 1957, p. 77–85.
9. Vsesojuznaja naučno - praktičeskaja konferencija po probleme 'Soveršenstvovanie metodov obučenija v sovremennoj sovetskoj škole', Leningrad, 1978. *Tezisy.* Red. komis.: I.D. Zverev i dr. Moskva, Akademija pedagogičeskih nauk SSSR, 1977. 4 v.
10. Babanskij, Ju.K.; Zverev, I.D.; Monoszon, E.I., eds. *Problemy metodov obučenija v sovremennoj obščeobrazovatel'noj škole.* Moskva, Pedagogika, 1980. 224 p.

CHAPTER THREE

Teaching methods compared with other educational concepts

As we have already said, it would be irrational to examine one educational phenomenon in isolation from another; when examining a concept it is incumbent upon the examiner to determine its proper position and its principal associations with other concepts. The deceptively simple daily scholastic routine is a process at once so complex and dynamic as to rule out an examination of the concept of teaching methods in isolation lest the reality should be distorted. In view of this, we purport to 'inscribe' the concept of teaching methods into the 'circumference' of education as such and bind it closely to the current problems of Soviet educational theory and daily school practice.

It may be appropriate to invoke an analogy between the linkages between educational categories applied to teaching and that of the components used in building construction.

The builders first come out with an idea or a design for the future edifice, as do the educationists in relation to the educational goal. The principles of building technology and architecture govern the realization of a design in much the same way as the theoretical principles of teaching govern the realization of teaching goals. The building materials specified in the architectural plans evoke analogy with the substance or content of education. The methods and techniques of construction, presupposing the use of specific technical and other equipment, may be compared with the methods and techniques of teaching. The detailed organization of the workers, designers and engineers on the site is another essential component of construction similar to the organization of the educational process. The above analogies serve to emphasize the integrity of the main components introduced into the process of education similar to the integrity of building components introduced into the process of construction. However, the provision of all the components making up a modern human being is a much more challenging enterprise than the creation of an edifice, no matter how grandiose.

Goals and methods

Teaching methods are first and foremost connected with teaching goals, either directly or indirectly, through the content of education. In a modern socialist society[1]:

> The purpose of public education in the USSR is to train highly educated, comprehensively developed and active builders of communist society, reared on the ideas of Marxism-Leninism, in the spirit of respect for Soviet laws and socialist law and order, communist attitude to

work, physically healthy and capable of successfully working in different areas of economic, social and cultural construction, actively participating in social and state activities, ready to selflessly defend their socialist Homeland, to preserve and augment her material and cultural wealth, protect and preserve nature. Public education in the USSR is called upon to ensure the development and the satisfaction of the cultural and intellectual requirements of Soviet man.

Proceeding from the Marxist-Leninist propositions with regard to the all-round and harmonious development of the personality, one can describe the goals of education as ideological and political, moral and ethical, intellectual, aesthetic and physical; the interconnections are sufficient for them to be viewed as a whole. Personal qualities may in turn be described as lying in the areas of competence, skills, convictions, behaviours, attitudes and action patterns. One of the principal objectives of education is to inculcate communist ideology and moral principles, which presupposes a scientific understanding of nature, an understanding closely linked with daily life. Attitudes to work are also considered vital – an honest attitude to work; an ardent desire to work for the common good; not merely for personal profit but as long as work is identified with public benefits – such are the qualities highly cherished by the communists. It is at work and through study that one develops a sense of being part of a community – an organized entity – a sense of discipline and duty. Basically, it amounts to the formation of such universally cherished human qualities as mutual respect, mutual aid, loyalty, sincerity, self-criticism and modesty.

It is by motivating every school boy and girl to participate in collective socially-useful work, in working out socialist standards of mutual attitudes and behaviours that one should be able to mould a personality worthy of a new socialist society. Marx emphasized the importance of encouraging the individual to interact actively and creatively with his social environment, as well as of motivating children to participate (as far as educational goals are concerned) in the work of adults. The process of making a man involves the assimilation and careful processing of human cultural heritage, since it is man who creates the world and his own self. Combining productive work with study is understood by Marxists as the 'only means of moulding a harmoniously developed personality'[2]. Also of importance to all-round personality development are proper education, good health, and honest morals and ethics. Thus, education takes its bearings from a profoundly humanistic approach. Viewed from this humanistic stance, the goals of formal education presuppose an active cognitive effort on the part of the pupils so that they have a scientific method of acquiring knowledge which can be used to acquire more knowledge in the future.

It is already at the school desk that a foundation is laid for continuous learning, involving the development from an early age of a lifelong quest for knowledge, which may assume the many and varied forms of self-instruction and, as a rule, go hand-in-hand with social and productive activities; or else, continuous learning may be combined with formal education in colleges and universities. The Soviet Communist Party programme states: '... the education of the younger generation should be closely linked with daily life and productive work, while the adults could combine work in the sphere of production with continuous study, which can only be of benefit to society'[3].

According to Brežnev, the future of Soviet society will depend on how and what we are now teaching in schools. We ought to be teaching the younger generation to be creative and self-reliant, with the emphasis on getting them ready to do something useful in life[4]. Making it possible for every schoolchild to fulfil himself, directing him towards doing socially-useful work, and giving him the motivation to do all this are goals which cannot be attained without appropriate teaching methods. In this case, the end fails to justify the means, since the honourable qualities of an individual worthy of living in future communist society are attainable only by equally honourable means (methods). In devising such methods, one should not rely upon dogmatism, classroom academics, authoritarianism or rote learning as a substitute for training, but rather upon respect for the child, a personality in his own right to be given everything needed to grow into a fully fledged, creative, free and happy individual.

The universal goals of education will be achieved through the attainment of particular objectives conceived in the context of teaching methods:

- the accumulation by pupils of sensory impressions, images and facts is expedited by the use of visual methods;
- pupils assimilate prepared, programmed information communicated by explanation and narration;
- the development of self-sufficiency in examining the nature and associations of phenomena largely depends on the acquisition of methods of analysis and synthesis;
- complete knowledge about the objects under study is acquired by systematic methods;
- the consolidation of knowledge is achieved by repetition, memorization and reproduction from memory;
- the acquisition of study-and-work skills in preparation for future work activity is expedited by means of experience in manual operations and exercises in design (using handbooks, making measurements, using tools and equipment);
- for evaluation purposes, a course of study is examined at intermediate stages and upon completion to confirm the solution of cognitive problems.

Depending on the objective in hand, it is possible at different stages of teaching to use a method, a group of methods or a part of a method.

Principles vis-à-vis methods

Educational goals are based upon a system of principles which in turn is based on criteria for selecting and constructing the content, methods and means of education, as well as its organizational forms. The principles underlying teaching are those universal guidelines resulting from a theoretical and methodological analysis of daily experience in school. In Soviet educational theory, no hard and fast single principle has yet emerged to identify other principles. For the time being, we are content to rely upon the general principles developed by a joint effort of educationists in the USSR and the German Democratic Republic[5]. Basic among them appear to be the scientific approach, Communist Party ideology, and a direct link between education and life.

The principle of a scientific approach requires that the content and methods of teaching foster an authentic perception of objective reality unadulterated by influences extraneous to science; it requires that teaching should contribute to the development of a scientific attitude in the pupils. Conforming to Communist Party ideology amounts to the education of every individual in the spirit of socialism. And finally, conforming to the principle of a link between education and life means that study should be connected with practical human experience. In the particular instance of formal education, various aspects of this vital principle serve to determine the methods to be used to achieve it. In this particular case we are dealing with the links between education, work and other activities (political, cultural, sport), which presupposes an assimilation of the theoretical background, analysis of practical problems, vocational training, physical education and developing aesthetic awareness.

If teaching is to be conducted in a regular and systematic manner, methods should be encouraged which organize proven facts, concepts, theories and laws in the context of a particular school subject and/or several school subjects into systems of interconnected elements (continuity, co-ordination, integration). Essential to the realization of this principle are logical processes.

Next comes the principle of the teacher's guiding role and the pupils' conscious activity, which is also essential to define the development of up-to-date teaching methods. The teacher's guiding role, however, can easily tend towards excessive authoritarianism. The idea is that the teacher, using the teaching methods available, should guide the child's activity towards a broad creative development. Teaching is thus interpreted as a purpose-serving process in which the teacher's reasonable demands, the pupil's intellectual background, self-reliance, initiative and self-discipline are all harmonized. Thus, this principle combines in itself teaching and learning aspects of methods.

Another principle states clearly that teaching methods should correspond to the pupil's age and his stage of development. The use of a particular teaching method, the duration of its use per lesson as well as the number of teaching methods in use are to be determined by the school age of the given cohorts of pupils. Since children differ in social, mental and intellectual backgrounds and also in personal interests and aptitudes, the teacher has to select methods with due regard to these differences. This is no easy selection, since in classroom work it has to be done through a delicate balance of collective and individual assignments. This approach presupposes an adequate knowledge of every child's inner self, in order to determine the selection of assignments and activity patterns in each case. And this requires a highly competent and experienced teacher. In so doing, recourse can be profitably made to specially developed teaching materials of varying degrees of difficulty, to non-official sources of literature such as anthologies or encyclopaedias, and, last but not least, while distributing assignments and setting activities the teacher is well advised to enlist the aid of the most proficient pupils to make it easier for the less proficient.

A principle of liveliness in teaching provides grounds for an optimal division between spoken word and visual image, which, while appealing to different cognitive faculties (rational and emotional), are intimately interconnected. A widely accepted principle in Soviet educational theory, based upon the findings of Zankov, is the advantage of the combined use of spoken word and visual image (concurrence

of visual impression and oral description) in describing the nature of phenomena during teaching. At the same time, a certain detachment from imagery helps to develop abstract thinking in the universal sense. Pictures are important in teaching because of their appeal to visual impressions and reasoning based on images, which is especially useful in solving cognitive problems.

The principle of comprehension and retention of knowledge seeks to stress the obligatory attainment of a certain level, i.e. the acquisition of course material, even though different pupils will reach different levels. In any event, this principle presupposes the development of teaching methods which would ensure a durable and conscious acquisition of knowledge, as well as work-and-study skills. In developing such methods it is recommended that stress be laid on building on the knowledge already acquired in order to acquire new knowledge, and to base teaching methods upon consolidating, repeating, applying and evaluating. Methods developed on this principle facilitate the teacher's task of leading the pupil on to further knowledge, of awakening in him intellectual, behavioural and, for that matter, physical potentials.

All the above principles are mutually interactive and complementary in that they provide a theoretical foundation for the development and application of teaching methods.

Content and method

The development of educational content in the form of new, continuously revised curricula and textbooks is closely associated with the dynamics of the theory of teaching methods and their practical application. The practicability of issuing curricula and textbooks on a long-term basis does not rule out a periodic revision of these substantive formal education documents. Accordingly, the Government decision that initiated the reform of educational content in the mid-1960s contained the following guidelines for curricula and textbooks:

- content should be updated in relation to the current level of scientific, technological and cultural progress;
- from the first year of school to the last, the principle of continuity should be observed;
- material should be distributed rationally over the years of formal study;
- the elements of science should be introduced from the fourth school year onwards;
- curricula should be disencumbered by the elimination of non-essentials.

Based upon the previous experience of educational theorists and schoolteachers, the above guidelines sought to encourage an in-depth study with a view to developing general principles and criteria for giving substance to education and its components. It was proposed in particular to draft properly substantiated recommendations on such involved issues as the form-to-content ratio in education, terms of reference of theoretical compared with applied concepts, systematization of recent research data and conservation of the scientific heritage, findings-to-conclusions ratio, the effective range of and the definition techniques for scientific concepts, and the in-teaching interaction of knowledge, study habits and study-and-work skills. The guidelines served to stimulate the development of principles to define educational content and components, and had an immediate positive effect upon the definition of teaching methods.

Concerning himself with progress in the age of technical and scientific revolution, Markuševič came up with a principle to accelerate the ability of pupils to assimilate knowledge in order to keep pace with dissemination of scientific achievements and their application in daily life. He divided knowledge into a substantive 'nucleus' (scientific theories, laws and concepts) and an evolving 'package'. However, when one is confronted with particular problems of selecting content for a particular subject matter, it is difficult to decide what belongs to the 'nucleus' and what to the 'package'. Some hold the opinion that many scientific facts and concepts may be classified as unique instances of a universal scientific law which have no place in the curricula. In such cases it is proposed to restrict a particular subject matter to the basic fundamentals. The guiding influence of a universal theory over particular subjects thus becomes a principal criterion for content selection so that greater integration of subject matters can be achieved on all levels of education. Together with this, one should not ignore the educational value of facts which, according to Lenin, play a unique and special role in the comprehension of objective reality. In other words, instead of giving excessive attention to understanding the world around us, one should start by giving the pupil the basic fundamentals of broader significance exemplifying the understanding of objective reality in the nature-society-man system. There is need to expand the components of formal education content to include:

- scientific facts, concepts, laws and theories;
- universal philosophical ideas; ideals;
- methods of scientific research and thought;
- information on the history of science to illustrate the evolution of scientific knowledge;
- theoretical foundations of production;
- work-and-study skills and habits[6].

The recent expansion of the content of education has gone a long way to fulfilling the new demands placed upon formal education. The main stress has been upon a system of scientific concepts which mould an individual's outlook. Much importance is attached to techniques of realization as well as to the development of those behavioural and moral attitudes which are laid down in the moral code of a Soviet citizen. Thus, there is firm resolve to move away from the earlier tendency which limited educational content to a narrow inventory of systematized knowledge.

Furthermore, scientific knowledge and the way it is applied cannot be examined separately. This interconnection is reflected in curricula and textbook content and, by implication, in teaching methods (to some extent incorporated into textbook content). It appears to bear out Krupskaja's emphasis on the close link of teaching methods with the 'very essence of instructional material'[7]. Makarenko believed that the principal problem, and the most complex one to solve for the teacher, is not 'what' but 'how'. This observation serves to emphasize the link between content and method.

Since teaching in Soviet schools is carried out by subjects, knowledge is systematized in textbook form – one textbook for each subject – their content affecting the solution to the problem of a satisfactory method. The effectiveness of teaching is evaluated through the acquisition by children of the main ideas, laws, concepts and facts as well as through scientific methods. The indissolubility of method and

theory is graphically exemplified in the integrity of the deterministic approach and the Pavlovian conditioned reflexes technique in physiology. The incorporation into teaching of certain characteristics of scientific methods depends on their 'didactic' adaptation to formal education. Here we mean only those basic scientific approaches which become suitable for use in schools after appropriate educational processing. Method-and-theory unity was verified by the author in an experiment on the application of Pavlovian techniques to animal and human behaviour while developing methods to teach biology in school[8,9].

In stressing the links existing in principle between teaching and a scientific approach, it is appropriate to highlight the many dissimilarities between them owing to the different purposes they serve. The history of education abounds in examples of the application of scientific methods to teaching (heuristic or discovery method, induction and deduction, observation, experimentation, modelling, designing, etc.). The reverse may also be true. Thus, Ušinskij's technique to identify useful phenomena in teaching to read and write has found application in purely linguistic research. However, scientific approaches are more frequently used in teaching than teaching methods in science.

Differentiation and integration to involve the interpenetration of sciences and the development of interdisciplinary research methods cannot but influence both the content and methods of teaching. Take, for example, the influence exerted by modern linguistic methods (descriptive, comparative-historic, comparative, structural-semantic, phonological, experimental-phonetic, dialectographic, mathematical, socio-linguistic) upon the modern methods of language study in school. Another example of the link between content and method is the employment of consolidated knowledge as a tool to acquire more knowledge, knowledge becoming part of a teaching method. Objective knowledge in its role as a cognitive instrument cannot be treated in isolation from the acquisition of intellectual activity techniques. Thus, the acquisition of teaching methods involves, besides knowledge proper, the acquisition of teaching skills and habits. This has been foreseen in the newly approved curricula. The requirements for the obligatory acquisition of skills and habits of a universal and particular character (work-and-study skills and habits), as well as for the obligatory acquisition of pure knowledge, will contribute to the considerable expansion of the array of teaching methods at the disposal of formal education.

The important thing now is to bring the existing methods into line with content according to the curricula approved by the USSR Ministry of Education in 1981, the salient points of which are as follows:

- a higher level of definition;
- improved logical processing and theoretical explanation of scientific data;
- the incorporation of theoretical postulates into curricula for individual subjects earlier in the school course;
- an increased share of deduction vis-à-vis induction in classroom situations;
- the intensification of polytechnical study of modern industrial production processes;
- an increased quantity of proven knowledge on the curricula presented in integrated and generalized form;
- stressing the linkages between school subjects;

- cutting down on background material in order to have more time to introduce material that will stimulate the pupils' intellectual development.

The educational content in the new curricula has been brought in to line with progress in the scientific, industrial and cultural domains, and with the recently introduced compulsory secondary education, all of which called for improvements in teaching methods.

Method and technique

There is close interaction between teaching methods and techniques. Only too obvious are the advantages of illustrating the teacher's purely verbal discourse by such auxiliaries as maps, slides, films and natural objects, as well as experimental demonstrations. The greater involvement brought about through the judicious use of teaching techniques, besides making material more digestible, is certain to have positive repercussions in the external manifestations of teaching methods, i.e. their supervisory functions, and their internal coherence and content. The sequence of presenting visual aids could follow the same pattern as the presentation of the main concepts of the subject being taught, thus helping the teacher to focus attention upon the essentials, to condense the material appreciably and accelerate its assimilation.

Teaching methods and techniques are employed for one and the same purpose. They may be used to motivate, introduce a particular segment of material, deliver the main substance of it, or else to confirm and evaluate its acquisition. Sometimes, for greater effect, it may be rational to employ several techniques simultaneously, such as, for example, showing the pupil a natural object and accompanying it with a running commentary on its dimensions, colour and other details. Using illustrations or slides enables a particular environment to be reproduced in all its complexity. A diagram may help to pinpoint the basic essentials in an object or phenomenon, and emphasize its interconnections. The growing complexity of the images presented or their juxtaposition is likely to contribute to a clearer understanding of the dynamics of a process, the functioning of a system. It follows from this that teaching techniques are mutually complementary and that it is possible to make teaching methods more effective by combining images of objects with the objects themselves. The use of technical equipment, such as audio-visual aids, seems especially promising.

All these teaching aids have been created to satisfy the requirements of the newly introduced educational content and to facilitate its implementation.

Combining illustrations with a verbal exposé in an audio-visual presentation, which has now become a possibility through the use of modern electronic equipment, serves to invigorate an educational process quite tangibly. For instance, it has now become possible to present in audio-visual form the sequence of proving scientific facts, of discovering laws and to survey the field of application of these facts and laws. The use of a wide variety of teaching techniques makes for greater initiative among the pupils while learning.

As far as the interaction of teaching methods with teaching techniques is concerned, a discerning teacher would not overlook the fact that it is important to distinguish between them as each is carrying a particular bit of information. Indeed,

the sense of a given piece of information can be conveyed via a teaching technique in vivid form simply to illustrate and confirm a law or a theory, or in the form of the successive revelation of the history of its discovery, or else in the form of setting a problem and giving the pupil an opportunity to 'discover' the law or theory. This choice of several options is further evidence that a teaching technique may play the role of a teaching method in that it promises a methodological solution.

The situation, however, may be reversed. Teaching techniques may be incorporated in the logical sequence of a method, being subordinate to it. Yet even in the reversed instance, the primary goal of a method is to reveal the content consistently, to focus teaching techniques on the salient points of material carrying the bulk of conceptual meaning which are hardest to acquire. The experience of subject-by-subject theoretical studies, involving a matrix analysis of subject matter, has identified the need for a build-up of a whole array of teaching techniques, as it were, at main-thrust points, i.e. at those stages of the teacher's presentation which are educationally the most important and provide a fulcrum for further educational content. However, the experience of Soviet schoolteachers and the findings of an in-depth theoretical inquiry into teaching techniques[10,11] favour moderation in the use of educational equipment and the subordination of providing knowledge through hardware in favour of the regular structure of a lesson given under the teacher's complete supervision, teacher/pupil feedback, and adequate and timely confirmation of knowledge acquisition. Too frequent and unjustified recourse to television and film may become an end in itself, the lessons turning into a sort of diversion, the purpose of television broadcasts and film shows getting blurred, their content no longer debated, with the result that the teacher may lose his rapport with his audience.

Moderation is equally called for in using television and film as a component in teaching the works of literature. The characterization inherent in such works is most adequately conveyed by the printed word; film-showings should not be conceived as a typical auxiliary. In that they presuppose narration, reading and discussion, oral methods remain of primary importance because they are capable of depicting and conveying the most subtle emotions. However, film-showings may be useful to add a new dimension, let us say, by providing material for an overall survey or a comparative analysis of the characters in a novel or a story. An overkill of hardware in teaching may very well result in clustering it up with all sorts of gadgets which attempt to usurp the place of a teacher, which by any standards amounts to theoretical and practical absurdity.

Method and forms of educational organization

A teaching method functions within the limits of class time and those conditions which organize the educational process. 'The best results in the shortest time' is a long-standing motto of traditional teaching. However, the time element will depend not only on the scope and complexity of material in hand, but also on the teaching method. A problem which has arisen recently, that of pupils' being overworked, is to be eliminated by appropriate revisions of curricula and textbooks, teaching techniques and methods, reorganizing classroom work and more carefully instructing the pupils on doing homework, the extent of which will be brought into line with

health standards. A solution to this problem being no easy matter, it is being sought through the combined effort of educationists, methodologists, psychologists and health workers. Motivation to learn, the scope and lucidity of content, methods of learning in school and at home are all associated problems the solution of which should determine the dosage of instructional material.

There are quite a few teaching methods which assume different forms when applied to such uses as classroom work, laboratory work, excursions, practical training, optional activities and out-of-school studies. Methods are normally defined in the matrix of classroom work. Ever since the times of Komenskij, classroom work has been the dominant form of organizing collective, group and individual learning activity, even though it has been under fire as an allegedly outdated form due to be replaced by free-attendance classes. In some countries, they have been experimenting with mixed age, mixed-ability classes. All these new-fangled practices rely upon the idea that the school is fast disappearing and are hardly compatible with the principles of Soviet educational theory and its application. The recent experiments on combining group work with collective and individual studies staged in the schools of Estonia, Moscow and Murmansk have little to do with the notorious teamwork, laboratory or Dalton-plan methods (Lijmets[12], Vinogradova[13] and others).

Even though in the Soviet experiments teaching methods are indeed aimed at giving the pupils more initiative, more opportunities for self-expression, this is done not to the detriment of the lesson as a unit. The Soviet educators have enough experience in this traditional form of learning to enable them to use it as a medium for testing and applying a wide variety of teaching methods without doing any harm to effective presentation. A number of studies specially devoted to lesson units (Oniščiuk[14], Mahmutov[15]) proceed by grouping lessons into systems and types, seeking to identify the main structural elements of the lesson and the best possible conditions for a most appropriate combination of teaching material, teaching methods and pupils' typical in-class activities. Each lesson's content determines the content of the next lesson, that of a few following lessons, and the selection of teaching methods to be used therein. Thus, if at the introductory lesson an adventure story is read or a problem set, at the subsequent lessons use is made of unsupervised learning methods which enable the pupils to consciously solve a learning problem. There are lessons wholly devoted to the consolidation of knowledge involving the use of exercises, applying acquired knowledge in new situations, and practising useful skills and habits. Revision lessons rely upon methods of evaluation, giving marks for the acquisition of knowledge, skills and habits. Methods may vary with the transition from universals to particulars and vice-versa. In other lessons use is made of what is known as a step-by-step integration of material. At every step, methods combined with content serve to develop the material, with each new item of knowledge or exercise enabling the pupils to acquire useful skills and habits. One should not denigrate the auxiliary role of methods in breaking the material up into individual parts according to its content.

While preparing the pupils for the acquisition of new material, or a review of material either already acquired or to be acquired, the teacher gives the pupils a task and gets them to undertake unsupervised work either as a whole class or in groups using methods of observation, measurement, experiment, modelling, etc. The type

of lesson is determined by the principal problem to be solved (it may be introductory, the presentation of material or can be devoted to the consolidation and understanding of material, and to evaluation and testing).

In short, the specifics of a lesson determine the methods to be used. Furthermore, teaching methods may vary according to the varying stages within a lesson (introductory, substantive and conclusive). One has to take into consideration, however, the fact that the use of methods within one lesson is restricted by the time allotted for each step and the age of the pupils. Thus, lessons for younger pupils simply have to be more diversified, which applies to all teaching techniques employed. In primary school, one may resort to ten or twelve different teaching techniques per lesson; this is only natural, since one lesson may serve several purposes. Yet in more senior forms a lesson is commonly dominated by a single teaching purpose (drilling, repetition, systematization, confirmation, evaluation of results, etc.). That is why, as far as senior forms are concerned, each lesson may belong to a particular category and the array of teaching methods is somewhat restricted. A lesson may be in the form of a debate, a lecture, a discussion and/or practice. The methods to be used in lessons for the age groups occupying a midway position between juniors and seniors are accordingly classified as the intermediate type.

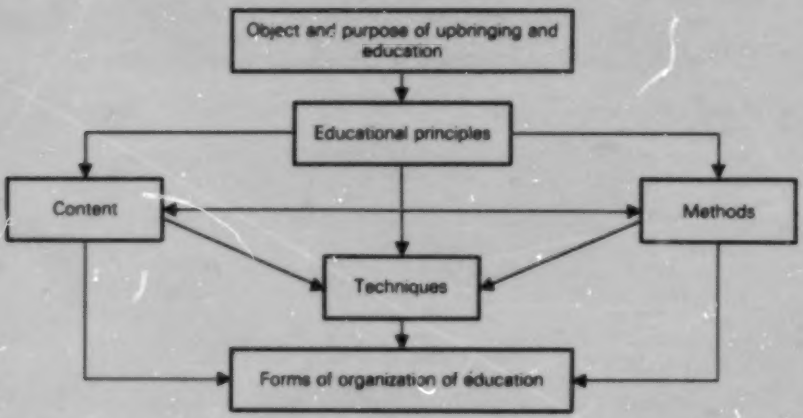
Other forms of organizing the educational process also constitute an important contribution to the development of the lesson. The specifics of such forms determine the selection and use of methods. Thus, lessons held in the laboratory usually involve giving instructions (commonly written on cards distributed among the pupils), reading diagrams, assembling experimental equipment, monitoring the experiment, observation, comparing results with the parameters of the problem set, drawing conclusions, etc. While in classroom lessons it is possible to adopt a more diversified approach and the use of the above methods could be somewhat limited, lessons in the laboratory make much use of these methods.

On study trips or excursions, the choice of methods is usually limited to observation (the predetermined and purposeful examination of an object), recording observation data, discussing the results and deriving conclusions. Methods used on study trips usually vary according to place, topic and purpose (sight-seeing, visiting a farm or a factory, going to a museum, etc.). The pupils have many possibilities to acquire methods of impartial observation, carrying out unsupervised preparations for a project, and have an opportunity to learn to work with different sources of knowledge in just as different settings (literature searches, in the laboratory, in the workshop, etc.) by attending the optional classes whose purpose is to let the pupils go deeper into the theoretical and practical aspects of scientific, technological and cultural knowledge. A pupil may, in his own time, work continuously on a particular topic and then be assigned to write a sort of abstract or thesis detailing his findings on the problem resulting from experimentation or an analysis of the literature or field data.

Such out-of-school groups as pupils' clubs, debating societies and extra-curricular projects in the school laboratory or workshop offer appropriate media for personal initiative, satisfying personal interests and pursuing favourite subjects. Often the pupils launch their own clubs or societies – sporting, working and theatrical (acting, singing and orchestral).

Certainly, there is a considerable contrast between, say, a scientific circle and a

FIGURE 2. The place of teaching methods in the infrastructure of educational concepts.



ballet-dancing group. An ecological club, to give another example, may cover as sharply varying pursuits as the study of ecosystems, the monitoring of environmental conditions, forecasting anthropogenic impact, on the one hand, and doing simple manual work in the field to conserve the environment, on the other.

A tentative programme for extra-curricular cultural activities may typically involve the use of methods of acquiring techniques to portray reality in the language of music, painting, etc. The methods to develop creativeness towards self-fulfilment would require a strictly individual approach. It presupposes the acquisition of the language of art criticism and aesthetics. At the same time, technical modelling relies essentially upon the acquisition of work-and-study skills and habits, the development of spatial vision, learning to think in terms of design, to do mathematical calculations, and last but not least, to educate oneself to seek innovation.

The existence of a vast variety of forms of carrying out teaching imposes not merely the need for just as vast a variety of methods but an equally adequate prudence in their selection depending on the specifics of all those forms.

The place teaching methods should occupy vis-à-vis the infrastructure of other principal educational concepts may be represented schematically as in Figure 2.

REFERENCES

1. Fundamentals of legislation of the USSR and Union Republics on public education. *Moscow news* (Moscow), no. 33(1180), 1973, supplement, p. 4.
2. Marks, K. Kapital. T.I. *In:* Marks, K.; Engel's, F. *Sočinenij.* 2-e izd. Moskva, Gospolitizdat, 1961, t. 23, p. 495.
3. Programma KPSS. Moskva, Gospolitizdat, 1976.
4. Brežnev, L.I. *Leninskom kursom.* Moskva, 1970, t. 2, p. 567.
5. *Pedagogika: maket dlja obsuždenija.* O.A. Abdullina, i dr. Moskva, Prosveščenie, 1978. 511 p.

6. Danilov, M.A.; Skatkin, M.N., eds. *Didaktika srednej školy: nekotorye problemy sovremennoj didaktiki.* Moskva, Prosveščenie, 1975, p. 47.
7. Krupskaja, N.K. *Pedagogičeskie sočinenija v desjati tomah. Tom. 3: Obučenie i vospitanie v škole.* Moskva, Izdatel'stvo Akademii pedagogičeskih nauk, 1959, p. 556.
8. Zverev, I.D. *Izučenie reflektornoj dejatel'nosti životnyh v škole.* Moskva, Učpedgiz, 1957.
9. Zverev, I.D. *Osnova sistemy obučenija anatomii, fiziologii i gigieny čeloveka.* Moskva, Prosveščenie, 1978.
10. Šapovalenko, S.G. Škol'noe oborudovanie i kabinetnaja sistema. *In:* Zimin, P.V.; Kondakov, M.I.; Socerdotov, N.I., eds. *Voprosy školove-denija.* Moskva, Prosveščenie, 1974.
11. Pressman, L.P. *Osnovy metodiki primenenija ekranno-zvukovyh sredstv v škole: posovie dlja rukovoditelej škol.* Moskva, Prosveščenie, 1979. 176 p.
12. Lijmets, H.J. *Gruppovaja rabota na uroke.* Moskva, Znanie, 1975. 64 p.
13. Vinogradova, M.D.; Pervin, I.B. *Kollektivnaja poznavatel'naja dejatel'nost' v vos'miletnej škole (iz opyta raboty).* Moskva, Pedagogika, 1977.
14. Oniščiuk, V.L. *Urok v sovremennoj škole.* Moskva, Prosveščenie, 1981.
15. Mahmutov, M.I. *Sovremennyj urok.* Moskva, Pedagogika, 1981.

CHAPTER FOUR

Psychological background

The theory of teaching methods is based upon the principles of general and educational psychology, i.e. the psychology underlying the educative process. A powerful stimulus to the improvement of teaching methods has been provided by the recent findings of psychology on the application of activity theory to teaching and on the sequential acquisition of study and comprehension skills (Vygotskij[1], Rubinštejn[2], Leont'ev[3], Gal'perin[4], Davydov[5], El'konin[6], etc.). The Soviet psychologists tend to reject functionalism, sensualism and associationism.

The prevailing view concerning educational activity is to consider it as cognitive. Any form of activity (working, learning, playing, art, sport) occurs in a definite variety of forms depending on the purpose it serves. With reference to work processes, Karl Marx notes that through work man achieves his conscious purpose in the manner in which a law governs the method and character of an activity[7]. And it is within the matrix of methods that teacher and pupil achieve the purposes of teaching/learning.

Soviet psychologists perceive a proper basis for the psychology of activity in the Marxist-Leninist philosophy. They conceive the formation of an individual as his progression in activity while he interacts with the environment and his own self. The activity of every individual occurs within the matrix of precise social relations, the satisfaction of his material and biological requirements being regarded as a contribution to, but not as a source of, the individual's development. 'The individual cannot develop within the limits of consumption, his development presupposes a digression of requirements towards creativity which alone is boundless'[8].

Personality self-awareness patterns, in the opinion of Soviet psychologists, typically constitute a major component of personality structure in that they serve to reveal an individual's substantive attitudes towards reality. It is his knowledge of proven facts, his ideological and moral standards that determine self-awareness of his personality.

As personality develops and grows in maturity, it acquires an ever greater freedom of opinion and creativity, and expresses in an increasingly confident manner any attitudes it may have to all that is going on around it, thus becoming increasingly active within its social milieu. In the absence of personal freedom one cannot very well hold an individual responsible for his actions, either morally or legally. As Karl Marx once put it, 'to ensure a free, many-sided personality development one has to humanize the circumstances making a human being'[9].

Absolutely essential to proper personality development is the process whereby an 'individual "appropriates" for himself the experience of earlier generations and thus reproduces in himself human abilities and functions'[10]. With growing awareness of the need to impart noval traits to the individual members of that society, 'educational science should orient itself upon the future of developmental psychology rather than upon its past'[11]. It is worth recalling that the growth of personality over time manifests itself not merely as activity, but also as psychological development. And any activity may be legitimately claimed to be a form of development and development a form of activity. Thus, activity and development are simply aspects of the same process.

The problem of personality education, whether in the universal or particular sense, should be approached with caution in view of the complexity of personality development, which is a multi-stage, many-sided and often controversial process. In any event, the principal forms of activity and the transition from one type of activity to the next should be encouraged. The typical stages in the psychological development of the personality in schoolchildren are briefly examined below.

Typical of the pre-adolescent age (7-12 years) are irregular psychic processes whereby the child begins to react to outside actions and situations by self-exploration. At that age, the children acquire morals within the matrix of school standards. Their manifestation of emotions is appreciably modified, their behaviour becoming more restrained and self-controlled. Compared with pre-schoolers, primary school children prove more governable. It is appropriate at that age to encourage the development in the child of positive behaviour patterns such as satisfaction of needs, the desire to know more, and the ability to admire and rejoice. In a community, the child learns to be responsible for his actions towards other children and adults, as well as to respect them.

Upon reaching adolescence, the teenager learns to adjust his behaviour and bring his feelings and desires more in accord with those of others. It is on this basis that moral judgement develops.

Characteristic of the adolescent period proper (13-15 years) are the 'crises' of personality development involving the instability of will-power, capricious moods, and an inclination towards conflicts with others. 'Development becomes more destructive than constructive' (Vygotskij). The teenager stands to lose more than gain. Simultaneously, there are positive changes (acquisition of greater self-sufficiency, development of new activity patterns). Becoming more and more important in this process are the motives for activity, which change into purposes, as well as the appearance of new motives which generate new types of activities (Leont'ev). As a rule, in a conflict situation, the stronger motive proves superior. However, when the adolescent is compared with an adult, it is emotions that typically prevail over reason. Decision making in the adolescent is commonly dictated by emotion, since he is not yet adept at pre-calculating the fruits of his actions.

On reaching relative maturity, young people typically acquire a more differentiated sense of civic experience and civic duty to help them take their bearings in their social milieu, which involves more acute self-awareness, more pronounced differentiation of interests, and a more apt choice of vocation. Prior to coming of age (16-18 years), the young person typically awakens to what adults and his contemporaries may think of his behaviour, and at this juncture he begins to assess it by

the moral standards he has already acquired. All this provides an additional incentive for value-orientation in the young person.

The most typical signs of this age are an inchoate self-awareness of one's own ego, beginnings of self-evaluation, and an attempt to compare what one strives to attain with what one has already attained. It is no less typical of the young to strive to gain the independence of an adult, this latter intention being manifested in the behavioural, emotional and moral-value spheres. Equally important for young people at this age is the desire to expand their communication sphere as well as their self-assertiveness in the company of their contemporaries in particular and in their milieu in general.

In adolescence and post-adolescence, an individual 'is likely to take true interest in the ideals of adults only if these ideals fascinate his youthful, romantic heart'[12]. According to Krupskaja, it is very important indeed to know how to set a goal, how to make the child try to achieve it by himself, and how to follow it up by setting even more challenging and long-term goals, so that each particular goal should reveal its connection to the universal one.

In short, typical of youth is a high level of social activity, a developing social outlook, broadening cognitive interests, and an ever-more independent approach to choosing his vocation. All these manifestations of personality progress in close interaction with the human, natural and social environment.

In the opinion of psychologists, a major role in the chronological development of personality is played by a self-adjustment of behaviour through the medium of moral-behavioural structure to involve situation analysis, purpose-setting, decision making and value orientations (acquisition of positive qualities to the exclusion of negative). This self-adjustment generally follows such personality development patterns as personality orientation (development of ambitions, motives and interests), personality awareness (self-evaluation, pretentions, social expectations), attitudes to oneself, others and to the environment, as well as moral attitudes.

In demanding situations, the level of self-adjustment depends on the levels of will-power development and consciousness differentiation, these latter levels in turn determining the level of personality activity in action. The highest level of this activity is exemplified in the unity of word and deed, and in the unity of moral attitudes and acts. Therefore, it becomes important to be aware of the social function of moral attitudes, once these attitudes have acquired the status of a moral value as regards personality.

In developing the pupil's moral attitudes in general, and his moral attitudes to man and nature in particular, the humanities and arts subjects on the school curriculum acquire special importance. These subjects should be used to the optimum in the process of schooling in order to inculcate into the pupil such motivations, views and attitudes as are most likely to govern his behaviour.

Leont'ev put forward an important idea that may prove useful in classroom work, having observed the significance of combining motives with such stimuli as the cognitive results of activity during schooling:

> Does not the art of teaching consist of creating the correct combination of the 'understood' motives and the 'real' motives and, at the same time, in the ability to accord more value to the successful results of activity in order to ensure transition to a higher type of 'real' motives, which govern the life of an individual?[13]

This statement reveals the machinery of interaction among essential motives which, in a particular instance, may be influential in solving educational problems. In fact, experienced teachers commonly call attention to the positive results of activity in classroom work.

Thus, moral stability of the personality results from orientation upon those morally valuable principles and models which motivate attitudes, actions and behaviours.

But what method is to be employed for the analysis of personality attitudes in their age-dynamics? This purpose is served by self-appraisal in so far as it reflects the influence exerted upon personality value orientations by the people in the immediate vicinity or, in the school, by the people who serve the pupil as a yardstick of his own acts and attitudes. Self-appraisal, inherent in personality structure, develops in the process of conscious existence. One should not, however, forget about the fluctuations in self-appraisal in the period of adolescence.

From activity theory it is possible to derive the following conclusions contributing to a solution to the problem under discussion: (a) activity and consciousness are interconnected and it is through them that the pupil expresses his attitude to learning, acquires learning techniques; (b) the dynamics, types and patterns of activity serve to condition personality development with age and to determine an assortment of methods to be used at the various stages of schooling; (c) personality traits develop with age in the process of acquisition of social experience and attitudes, a process concomitant with the acquisition of learning techniques; (d) value orientations are derived from moral awareness, emotional development and will power, such value orientations providing stimuli for learning motivation; (e) personality self-appraisal has a positive influence on values of action and conduct, and helps develop a self-critical estimation of a personal learning record.

Of direct consequence to teaching methods are the findings of psychology on the development of thinking patterns which are classified with the category of logical educational methods (Kabanova-Meller[14], Menčinskaja[15]). With reference to thinking patterns, psychologists proceed from the premise that there are two interconnected, though opposing, trends in the dynamics of pupils' reasoning: either towards greater abstraction or towards greater concretization (Blonskij[16]). From this follows Anan'ev's argument that 'theoretical knowledge in the form of acquired concepts, far from hampering the formation of sensual, momentary images, is on the contrary the main pre-requisite of their being concrete, non-fragmentary and stable'[17]. The function of the concrete (particular) and the abstract (universal) varies with the teaching goals. Thus, according to Menčinskaja, even senior students often feel the need for a novel abstract notion to be interpreted in concrete terms, whereas in solving a concrete problem the pupil should resort to an abstraction to grasp the general principles. Psychological data seem to bear out this abstract/concrete variability.

A new trend in the evolution of teaching methods is represented by Davydov who has come up with the content-conceptualization theory[18]. Here, operations are imparted to the pupils to enable them to acquire theoretical concepts through the conceptualization of content. This approach stimulates the development of conceptual reasoning vs. empirical reasoning, the latter merely reflecting the outward characteristics of phenomena while hardly touching the essence. Whilst empirical

reasoning proceeds in a concrete-to-abstract direction, conceptual reasoning takes the opposite course. According to Davydov, the process of acquisition of a concept involves:

1. Acquainting the pupil with the given situation or problem, as well as his general orientation;
2. Learning the pattern and discovering vital connections;
3. Reconstructing the connections in real and symbolic models;
4. Discovering the conditions and modes for solving the problem set.

The next step is a definite educational requirement of getting the pupils into the habit of discovering by themselves the properties of objects and phenomena.

Soviet psychologists and educators have recently been debating the desirability of a limited application of content-conceptualization practices in teaching to strike an equilibrium of conceptual vs. empirical (abstract vs. concrete) modes of reasoning. Davydov's approach, undoubtedly novel and original in character, is a step forward in the evolution of teaching methods. There are definite educational advantages in this method in that it explains the genesis of objective knowledge through the analysis of scientific methods in so far as they are used in teaching. However, the transition from abstract to concrete should not be conceived as a recipe for all classroom settings and for all school ages.

The theory of teaching methods also benefits from Gal'perin's psychological theory of the stage-by-stage evolution of operations, this evolution being divided into: (a) mastering mental operations; (b) conceptualization; (c) completion; (d) measure of mastery. At first, the pupil is told how to approach operations in general, which involves the differentiation into sub-operations. The subsequent three stages cover the progression of actions. The pupil progresses through these three stages by trying various approaches (trial-and-error). The pupil's approach to operations may depend upon the teacher's preliminary guidance or an analysis of the tasks to be performed. All this material can be developed into proper teaching methods specifying the principal stages in operation acquisition (sequence, mode and procedure). In this particular case, preliminary guidance involves manipulating real objects (sticks, apples, model figures). For senior school forms it is preferable to use graphs, drawings, symbols. Gal'perin has demonstrated the feasibility of using simplified operations in the first instance to facilitate mastery of the problem. The stage-by-stage conceptualization the pupil is expected to carry out renders the mental-process pattern within the limits of the operation sufficiently succinct to enable the pupil to use it to discover the sought-for phenomenon in a relatively short time, i.e. to pinpoint it (e.g. to identify the subject in a sentence or the bisector of an angle).

The psychological theories cited above tend to emphasize the following aspects in teaching methods:

- Links between the content and type of activity;
- The motivation of learning and the development of cognitive interest in acquiring both the content of material and the techniques of teaching/learning;
- Emphasizing the qualitative differentiation of different teaching stages and the applicability of a particular teaching method to each stage;

- The optimum combination of the two processes in revealing content: concrete-to-abstract compared with abstract-to-concrete;
- Using methods to shed light upon the genesis of knowledge acquirement in terms of the history of science;
- Activation of control and self-control at every stage of conceptualization by transfer-of-knowledge methods and their application in a new setting.

REFERENCES

1. Vygotskij, L.S. *Izbrannye psihologičeskie issledovanija.* Moskva, APN RSFSR, 1956.
2. Rubinštejn, L.S. *Problemy obščej psihologii.* red. E.V. Šorohova. Moskva, Pedogogika, 1973. 423 p.
3. Leont'ev, A.N. *Dejatel'nost'. Soznanie. Ličnost'.* Moskva, Politizdat, 1975. 304 p.
4. Gal'perin, P.Ja. *Obučenie i umstvennoe razvitie: materialy IV Vsesojuznogo s"ezda obščestva psihologov.* Tbilisi, 1971.
5. Davydov, V.V. *Vidy obščenija v obučenii: logiko-psihologičeskie problemy postroenija učebnyh predmetov.* Moskva, Pedagogika, 1972. 423 p.
6. El'konin, D.B. *Psihologija obučenija mladšego škol'nika.* Moskva, Znanie, 1974. 64 p.
7. Marks, K.; Engel's, F. *Sočinenij.* 2-e izd. Moskva, Gospolitizdat, 1961, t. 23, p. 189.
8. Leont'ev, A.N. *Op. cit.*
9. Marks, K.; Engel's, F. *Op. cit.*, t. 20, p. 294-295.
10. Vygotskij, L.S. *Umstvennoe razvitie detej v processe obučenija: sbornik statej.* Moskva, Učpedgiz, 1935, p. 252.
11. Vygotskij, L.S. *Izbrannye psihologičeskie issledovanija. Op. cit.*, p. 277.
12. Krupskaja, N.K. *Pedagogičeskie sočinenija v desjati tomah. Tom 5: Detskoe kommunističeskoe dviženie, pionerskaja i komsomol'skaja rabota, vneškol'naja rabota s det'mi.* Moskva, APN RSFSR, 1959, p. 37.
13. Leont'ev, A.N. *Problemy razvitija psihiki.* Moskva, Moskovskogo universiteta, 1981, p. 513.
14. Kabanova-Meller, E.N. *Psihologija formirovanija znanij i nav'kov u škol'nikov: problema priemov umstvennoj dejatel'nosti. Moskva, APN RSFSR, 1962. 376 p.*
15. Menčinskaja, N.A. *Obučenie i umstvennoe razvitie: materialy k simpoziumu, ijun'-ijul' 1966 g.* Moskva, Prosveščenie, 1966.
16. Blonskij, P.P. *Izbrannye psihologičeskie proizvedenija.* Moskva, Prosveščenie, 1964. 547 p.
17. Anan'ev, B.G. *Psihologija čuvstvennogo poznanija.* Moskva, APN RSFSR, 1960, p. 297.
18. Davydov, V.V. *Op. cit.*

CHAPTER FIVE

Functions of teaching methods

The relationships between teaching methods are extremely involved.

When we pose the question of how to teach, we mean what teaching methods should be employed, understood as the modes of imparting and mastering knowledge through oral presentation, demonstration and experimentation, including the evaluation of the pupils' mastery of material, which presupposes getting the pupils to listen and controlling their understanding, and, finally, we mean the acquisition of habits of logical thinking involving the selection of different combinations of the abstract and the concrete or, in other words, of those techniques which vary the degree of intellectual versus emotional responses. To sum up, we may say that all teaching methods should fulfil three related functions: education, upbringing (behaviour training) and personality development. How these functions manifest themselves and how they interact are two questions which have been debated for some time past before gaining their present educational interpretation.

The function of education is to enable the pupil to acquire knowledge, learning skills and working skills. The teacher uses particular techniques to deliver particular forms of knowledge in class. The essential requirement in this context is, to be sure, to enable the pupil to acquire a specific piece of knowledge or a specific mode of learning activity. However, hardly less essential seems to be the acquisition of personal qualities through education, since the acquisition of knowledge is subordinate to the more universal goal of upbringing. Methods to teach should at the same time be methods to mould personal qualities and it is the combination of these two functions that enables personality and intellect, as well as emotions, to be developed. This goal may be attained either by methods wholly oriented on personality development, or, in Ušinskij's phrase, personality development may be attained 'as a by-product' in the process of knowledge acquisition. In either case, teaching methods have a definite role to play, since intellect also is developed through practical knowledge and behaviour training.

Zankov[1], Suhomlinski[2] and others attach great importance to upbringing in formal education. The goals of moral and civic training, in their opinion, should determine both the content and methods of teaching. It is impossible to educate without training for upbringing. Now that the roles of upbringing and education in personality development have been established, it appears logical to seek new ways and to modify existing methods and techniques. Let us take an example.

In conformity with the goal of training junior pupils to conserve the natural environment, the teacher could use a system of traditional techniques to identify natural objects (familiarization, definition, differentiation, characteristics), to un-

derstand the relationships between natural phenomena (the dependence of animals on plants, the influence of seasonal changes, the interactions between animals and plants) and the influence of man upon nature. The observation of natural objects in field and forest, the comparison and description of natural phenomena, and the encouragement of constructive attitudes to nature in general, all contribute to the expansion of knowledge about nature and the acquisition of techniques of plant care and looking after pets at home and in school. The child is initiated into the general knowledge of nature. However, this initiation is subordinate to the practical purpose of teaching the child to safeguard and protect the natural environment. And this can be done by encouraging the child to conduct independent observations, giving him appropriate assignments, developing in him the sense of natural beauty, natural colours, scents, sounds, the sensation of nature in perpetual motion in all its diversity. All this should awaken in the child such behaviour as readiness to give a helping hand to an animal in trouble or to salvage an injured plant, so that the child identifies man, animal and plant in his mind as elements of a common system.

These qualities are developed by the use of established techniques to create situations which require the pupil to take a moral stand, an immediate decision and act upon it promptly, such as, for example, preventing damage to the environment, protecting a nestling, a cub, a frog, etc. Giving upbringing its proper place in the context of education presupposes the development of techniques to put across to the pupil the crucial importance of nature for the survival of mankind. One should guide the pupil to perceive the unity of man and nature. Thus, the atmosphere should be propitious for a meaningful solution to the broader problem of intellectual and emotional development.

The teacher has at his disposal a whole array of techniques of communication and consolidation, analysis and synthesis, demonstrating cause-and-effect connections as well as exercises to encourage disciplined behaviour, practical attitudes, willpower, perseverance and initiative.

The example given above serves to stress a global approach to the problems of education, upbringing and personality development, which involves the appropriate selection, organization and articulation of educational material, as well as methods to attain the desired objective.

In the past, these problems were hardly tackled at all. The religious doctrine of the pre-revolutionary school with its uninspired, purely descriptive approach provided little stimulus to intellectual development. At the same time, the increasing stress upon utility hardly prompted preference for a global attitude towards natural phenomena but rather acted to encourage blatant exploitation and commercial values.

The goal of environmental education should be based upon the analysis of material, intellectual and moral values. By placing stress upon the latter, teaching can be elevated to a level at which the various functions of teaching methods are harmoniously combined. Any educational setting can be readily explained in terms of the polyvalence of its methods, and their appropriateness to the content of education. The teacher should not restrict himself to teaching how to read, write and calculate, but strive to develop in the pupil conscious attitudes to the above activities, as it were, a drive to develop his own views, to define his own behaviour, i.e. qualities

usually associated with upbringing and environment. The question of how and what to teach is not an academic matter.

The systematic imparting of educational material should be based upon a system of objective concepts. The sequence of teaching methods should above all determine the development of the pupil's awareness and spontaneity as far as psychic processes go. Such awareness expressed in behaviour is not merely a quality of intellectual development, but an indication of proper upbringing. This kind of awareness is also bound to influence the development in the pupil of sound attitudes towards learning and work, i.e. the development of what is known as motivation. Vygotskij writes: '...it is only in a system that the acquisition of a concept may give rise to awareness and spontaneity'[3]. The acquisition of concepts goes hand-in-hand with the acquisition of attitudes towards them. Teaching methods in all these processes serve to solve the problems of general and specialized development, discovering and stimulating an individual's aptitudes, and his acquisition of specific practical skills.

In the early 1960s, just criticisms were levelled at the existing curricula and deficient, outdated teaching procedures which were holding back the pupils' intellectual growth. The subsequent reform of methodology was not to the detriment of material knowledge, since 'development without knowledge acquisition serves little or no purpose'[4] and nevertheless teaching still remains a largely haphazard procedure which fails to provide adequate stimulation for the pupil's all-round development. There is still a need for educational content to be reoriented and reorganized, as well as for teaching techniques to be capable of fostering the steady acquisition of knowledge and conscious intellectual development of pupils to an acceptable level.

The developmental function of teaching methods would be adequately reinforced if due account was taken of Menčinskaja's classification[5] of intellectual development into three levels:

1. The development of a system of knowledge;
2. The acquisition of methods and techniques of reasoning;
3. The development of intellectual qualities (self-criticism, self-reliance, flexibility, etc.).

To make this idea of Menčinskaja's work, one should make use of techniques to get the pupils involved in the educative process, stimulating their positive attitudes to learning. The development of intellectual activity presupposes the acquisition of knowledge necessary to impart definite qualities to the intellect. Methods to develop cognitive skills in the pupils are grouped according to the following activities:

- the use of acquired knowledge to gain new knowledge;
- the comparison of newly acquired concepts with those previously acquired;
- the verification and consolidation of previously acquired knowledge;
- the application by the pupils of acquired knowledge in a new setting.

The very fact that the result of upbringing cannot be equated with the result of intellectual development shows that, as far as teaching methods are concerned, these two functions are separate even though related. Intellectual development may also result in improved perception (observation), reasoning (mental techniques and habits), practical abilities (skilfulness, designing, etc.). Each of these intellectual

developments is attained by an appropriate method which is selected with regard to the relationship between the capacity for observation, reasoning and practical action. The application of analysis during observation serves to develop reasoning power sufficiently to enable the pupil to understand, while the practical actions based on observation in turn serve to stimulate conceptual thinking. Teaching methods taken separately cannot be demonstrated to fulfil educational, behavioural and developmental functions. It appears more logical to perceive their common function thus embracing the educative process as a whole rather than try to interpret it piece by piece.

Another one-sided approach is to construct methods solely oriented on personality development disregarding knowledge acquisition, which amounts to an artificial separation of abilities from the concrete acquisition of knowledge. Still another instance of one-sidedness is to reject the knowledge-reproduction method altogether, thus depriving the pupil of an important means in solving the problem he has been assigned. This is just further proof of the direct links between educational and personality development methods. 'Any idea entering one's mind inevitably contains in it elements which have been retained in one's memory before'[6]. This quotation, from the eminent Russian physiologist A.M. Sečenov, is still valid today in view of the current attempts to solve the problem of maintaining an equilibrium between education and personality development, as well as that of procuring methods to commit 'new' ideas to memory as they arise. Thus, it is not only reasoning but also memory that is being developed through the application of the right method. Methods are also selected for the specific purpose of developing in the pupil the power of concentration and listening, since these are an indication of intellectual progress and readiness to acquire knowledge.

Recognition of the developmental function of teaching methods eliminates the need for their division into passive and active. A method cannot be effective unless the pupil is active. Indeed, reproductive learning can be both productive and active at the same time. In any case, the reproductive learning method cannot very well be dismissed as deprived of a developmental function and relegated to the category of outdated methods. Furthermore, the activity of productive and reproductive methods governing education, personality and development is manifest in the overlapping of their functions. Any method may be regarded as a potential activator of the pupil's reasoning power. The developmental function of a method presupposes its being active at every level of instruction in that it enables the acquisition of both second-hand knowledge and knowledge imparted through guided discovery (at least partly). This function appears to grow in complexity like a spiral. Thus, in junior and intermediate school, use is made of methods involving analysis and synthesis, comparison and classification (systematization), induction and deduction, generalization and consolidation, each method definitely contributing to intellectual development according to the degree of its use, while intellectual development itself is, in turn, determined according to the pupil's age and personality. These methods are used according to the ability of a pupil to set and formulate by himself new learning problems and suppositions, to evaluate them, single out in them what really matters, find commonality and contrast in the phenomena under scrutiny, and to grasp the general principle as a means to further learning.

The need for imparting such capacities to the pupil involves a need for methods

with multiple functions. The behaviour training function of teaching methods is likewise appraised according to its capacity to foster the development of ideological and political, moral and aesthetic capacities, and industriousness in the pupil. The development of outlook is effected through the use of methods of verification, discussion, analysing cause-and-effect connections and familiarization. By definition, these methods involve a fine grasp of a system of scientific concepts. Required behaviour patterns are imparted to the pupils through debate, literature, and developing personal judgement and a personal social code. It is teaching methods that govern the conversion of knowledge into convictions, into a system of the pupil's views. Senior school formers declare that such conversion depends on the reliability of evidence, the methods of persuasion used, the validity of arguments and on the corroboration of conclusions with the facts.

In order to improve the behaviour training function of teaching methods it is essential:

- to keep in mind in the classroom the objectives of education, behaviour training and personality development;
- to select arguments, models and examples that are drawn from the everyday life and personal experiences of the pupils;
- to encourage the establishment of an individual set of values without imposing the teacher's own judgement;
- to reinforce the ability to argue constructively through a confrontation of views, a comparison of various points of view and a defence of one's own opinion.

The behaviour training function of teaching methods is based on the interaction of rational and emotional aspects in the course of lessons.

A method gains much in impact if knowledge is imparted emotionally, stress being laid on the salient points thus enabling full use to be made of the method. An emotional approach provides an intensely human background to the educative process in that it creates an informal atmosphere of sincerity, not, however, at the expense of mutual respect between teacher and pupil. The following is an extract from a press report featuring a lesson in a primary school in the Republic of Georgia[7].

The teacher introduced the subject of bread on which depends the well-being of the entire nation. The schoolmistress supervising the lesson unobtrusively encouraged the pupils to talk about their family's attitude, their personal feelings, and relevant examples from Soviet history and literature. She shows photographs to illustrate particular points and shares with the pupils her personal views on the subject. The children are beginning to see in bread a symbol of life and well-being. The schoolmistress reinforces her point with vivid illustrations from literature:

'...a stale loaf of bread, a priceless treasure in famine-stricken Moscow aflame with revolution, is brought to Lenin in the Kremlin by a soldier.'

'...militant collective farmers are gunned down while guarding the gates of a communal granary by the treacherous bullets of well-to-do villagers opposing collectivization by force of arms.'

'...combine harvesters tackle the virgin expanse of fertile land being brought under cultivation by the will of the Party and people, a vital contribution to the nation's well-being.

'Whatever its market price, the real value of bread is life.'

'While on a visit to a Leningrad cemetery for the victims who died of starvation during the fascist blockade', recalls the schoolmistress, 'I saw on the ground, beside a modest bunch of forget-me-nots, a letter weighed down with a crust of bread. It read: "Dear mum, I brought you one of the crusts of bread you saved my life with in the blockade."

And at this point, the schoolmistress assumes quite a different tone: 'Now, tell me frankly, please, do you throw away any of the crusts of bread you have no use for at home?'. Those making a clean breast of it, however, are treated by the teacher and the class with respect rather than scorn, since the educational value lies not in severity, but in the very forceful content of discussion, its spontaneity. Even when employing the best methods, the most important thing is the teacher's personality which alone can impart the right tone to the discussion and hence the right background for the method to achieve its effect.

One can hardly overestimate the educational value of a lively dialogue which can be neither invented nor repeated. A vivid, forceful image focusing attention on things that really matter, passing moral judgement, such are truly magic wands in the hands of a teacher. Thus, an inspired message from a no less inspired political writer and journalist, Marietta Šaginian, recently published in the press and addressed to schoolchildren, stimulated a great deal of teacher/pupil feedback in a literature class in one school. The message opens like this:

Never hesitate to turn for moral support to the writings of Lenin, for he was a man of exemplary stature, great kindness, indomitable courage, and who sought truth and justice without respite. Never remain indifferent to human grief and suffering. Steel yourselves to fight your own fight for truth and justice... For you that have the riches of time, do not waste it.[8]

Reading this message in class motivated the pupils to a frank, lively exchange on burning moral and ethical issues. Indeed, it gave the teacher a unique chance not only to enhance comprehension in literature, but also awaken the pupils to what was going on far beyond the classroom walls and instil in them a sense of civic awareness.

These examples will hopefully dissuade teachers from simple reliance on dull teaching and will serve as a reminder that really effective teaching involves innovation and initiative, not teaching for teaching's sake. To teach is to seek to develop personality, to make the pupil an adult worthy of our time.

It is sometimes asserted that in the classroom little use is made of training specifically intended for upbringing, instead teachers have a tendency to prefer educational methods that stress the upbringing function. This is not the case, however, since the teacher frequently resorts to methods expressly designed to highlight matters which, though related to teaching, emphasize the upbringing function. Even though, as far as educational theory is concerned, there is no such thing as upbringing methods, the teacher in his day-to-day work uses a whole array of such methods involving debate, information, exercises, stimulation, the assessment of aptitudes and prospects, evaluation and control, encouragement and censure. Certain upbringing methods are labelled as teaching methods for the simple reason that the relationship between these two categories is still awaiting clarification.

REFERENCES

1. Zankov, L.V., ed. *Obučenie i razvitie: eksperimental'no-pedagogičeskoe issledovanie.* Moskva, Pedagogika, 1975, p. 396-398.

2. Suhomlinskij, V.A. *Kak vospitat' nastojaščego čeloveka: sovety vospitateljam.* Kiev, Radz'janska škola, 1975, p. 3-5.
3. Vygotskij, L.S. *Myšlenie i reč': izbrannye psihologičeskie issledovanija.* Moskva, APN RSFSR, 1956, p. 248.
4. Ušinskij, K.D. *Sobranie sočinenij.* Moskva, t. 8, p. 617.
5. Menčinskaja, N.A. Puti realizacii v psihologii principa edinstva vospitanija i obučenija. *Sovetskaja pedagogika* (Moskva), no. 9, 1975, p. 8-17.
6. Sečenov, I.M. *Izbrannye proizvedenija. Tom 1: Fiziologia i psihologija.* Moskva, 1952, p. 320.
7. *Pravda* (Moskva), 15 maja 1982.
8. Ibid.

CHAPTER SIX

Classification of teaching methods

As far as the theory of methods goes, their classification still remains an unsolved problem. The controversy over this issue sometimes absorbs educationists and methodologists so deeply that they tend to neglect other aspects of the concept of teaching methods in favour of purely academic arguments far afield from the practical issues of formal education. Yet, this is not to say that the very idea of classification of teaching methods in the educational, and particularly methodological, senses is futile, provided such a classification has some application to classroom work.

In the first place, there is no agreement as to the feasibility of a taxonomy; some educationists would separate the classification of methods from their nomenclature; there is a clash of opinions as to how many methods there should be (3 or 300); neither is there any agreement on the grouping of methods, some suggesting one, others two, still others three or even four bases for such grouping; and finally, the development of a general taxonomy is still little connected with that of a particular methodological classification.

A common structure for the classification of methods is based upon methodological, logical and historical findings. Both in educational theory and psychology, there are already enough grounds to make a start. Reference to these findings has been made earlier in this text. A variety of approaches to the grouping of methods has been suggested both by theorists and schoolteachers. A typical drawback of the existing classifications is the adoption of one or several characteristics of methods as a base upon which the authors proceed to construct a system which by any standards cannot be claimed comprehensive. Another and most frequently committed error is to enumerate methods without dividing them into groups. Other authors advance incompatible inventories of methods. All these erroneous classification attempts are summarized in Table 1 (revised version of Lerner's table, 1981).

In the search for a taxonomy there seems to be an increasing reliance on the internal content of method, even though, initially, classifications of methods were constructed on the basis of the principal (external) function. Thus, in 1956, Danilov came to the conclusion that the logical basis of method was the most important for classification. Also in 1956, Perovski stressed the sources of knowledge and the ways knowledge is acquired to classify methods into three groups: (a) methods to transform reality (practical); (b) methods to stimulate image perception (visualization); (c) methods making use of broad communication (verbalization).

The classification by sources of knowledge, to which different authors tended to

TABLE 1. Nomenclature of methods as they appear in educational literature.

Method	References[1]													
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
Narration	●	●	●	●	●	●	●	●	●	●	●	●			●
Teacher's discourse	●	●			●	●	●	●	●	●	●	●			●
Lecture	●	●	●	●	●	●	●	●	●	●	●	●			●
Teacher/pupil dialogue	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Using textbooks or other books	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Illustration	●	●	●	●	●	●		●	●			●			●
Demonstration	●	●	●	●	●	●	●	●	●			●			●
Laboratory work	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Written tests	●	●		●	●	●			●						
Practical training	●	●				●	●	●		●					
Independent work			●						●	●	●				
Working on the school garden or workshop		●													
Exercises		●	●	●	●				●	●	●	●	●	●	●
Problem orientation		●	●		●		●			●					
Vocational training incl. productive work				●											
Excursions	●	●	●		●	●			●						
Pupil's projects							●			●					
Memorization					●										
Using works of art							●								
Experimentation										●		●			
Practical application of knowledge in new settings									●						
Creative oral and written exercises											●				
Programmed instruction											●				
Repetition											●	●	●		
Discussion													●		
Guided discovery															
Observation														●	
Methods involving evaluation and testing															●

1. See reference [1] at end of chapter.

give different substance, proved the most enduring and widespread. This classification essentially involved: (a) oral methods (narration, explanation, lecture, dialogue); (b) visualization (various visual aids); (c) practical methods (giving instructions, problem solving, using a book, observation and experimentation, etc.). According to particular tasks at particular stages of teaching, Esipov and Danilov (1957, 1967) came up with the following taxonomy: I. Acquisition of new material: (a) preparing the class to listen to the teacher's presentation; (b) the teacher's presentation proper; (c) clarification and consolidation of material; (d) unsupervised acquisition of knowledge; II. Acquisition of work-and-study skills; III. Practical application of acquired knowledge; IV. Practising creative pursuits; V. Revision; VI. Evaluation. This system stresses the character of teacher/pupil activity.

Another version of this approach was represented by teaching methods of two types: I. The teacher's introduction or presentation (dialogue, narration, lecture, film-showing); II. Teacher-guided but otherwise unsupervised learning (using a textbook, a book, observing, experimenting, doing manual work).

Mahmutov (1972) arranged methods into groups according to the degree of pupils' initiative in the eductional process; thus, he would divide methods into: non-motivating (communication of information and execution); explanatory-illustrative (reproductive); and motivating methods (guided discovery and illustrative).

Thus, the division of methods into groups was increasingly preferred to making an inventory. Without detailing all these attempts at classification, we shall merely say that the classification of methods into a single system was no longer acceptable to theorists, even though to teachers this relative simplicity still seemed attractive. In the end, the theorists opted for binary classifications.

In dealing with this type of classification, note had to be taken of the multiple aspects and functions of methods, while the teacher had to be oriented to their optimum application. At this time, Rajkov chose an innovative approach by identifying two groups of methods in teaching natural history[2]: A.1. Oral method (using a book); 2. Visual method (demonstrating objects); 3. Motor method (activity); B.1. Illustrative method; 2. Discovery method. He would have liked to arrange these two groups into various combinations having particular characteristics reflecting such aspects of methods as verbal-illustrative, verbal-discovery, motor-discovery, motor-illustrative, etc. In Table 2 six combinations are presented to reflect various forms of organization of the lesson. This was a schematic presentation of a binary nomenclature of methods, each of the six binary methods accompanied by a brief description of the particulars of its organization.

Attempts to combine source and logical aspects in classifying methods have been made by Verzilin and his colleagues[3]. They propose the following arrangement: 1. Oral-inductive; 2. Oral-deductive; 3. Visual-inductive; 4. Visual-deductive; 5. Non-oral-inductive; 6. Non-oral-deductive.

Another binary system, proposed by Aleksjuk[4], amounts to a combination of two other methodological aspects: a source aspect and an aspect to stimulate pupils' cognitive self-reliance and initiative. This version is presented schematically in Table 3.

Still another version of a binary classification of methods, this time to teach chemistry, was proposed by Ivanova[5] (Table 4).

TABLE 2. Six combinations of teaching methods.

Form of work	Designation of method
1. Lesson assignments in the laboratory (practice) and study trips for research purposes. Pupils work independently, with the teacher assuming a guiding role.	Motor-discovery
2. Lesson assignments in the laboratory (practice) and study trips for illustrative purposes. Pupils work independently, with the teacher assuming a guiding role.	Motor-illustrative
3. Visual (demonstration) lessons of a discovery nature in the classroom. The teacher demonstrates objects, conducts experiments. Pupils watch, make notes and drawings, etc.	Visual-discovery
4. Visual (demonstration) lessons of an illustrative nature. The teacher demonstrates objects, conducts experiments, while pupils make notes, drawings, etc.	Visual-illustrative
5. Oral lessons — talks of a discovery nature in the classroom without visual aids. The talk is teacher-guided.	Verbal-discovery (heuristic)
6. In-class lessons — talks (pure dialogue without visual aids).	Verbal-illustrative

In a simplified version, the combination of source of knowledge and the level of pupils' self-reliance had earlier been constructed by Brunovt and Zverev[6] (Table 5).

In terms of the binary approach, the methods total nine groups. In constructing the above combinations, the authors were guided by a desire to present the levels of learning activity graphically, a concept which had first been formulated by Lerner[7] as constituting five methods: informative-incremental, reproductive, problem-oriented, heuristic and discovery. Later, the author chose to unite the methods into larger groups of teacher's and pupils' activities. Table 6 presents this configuration in tabular form.

The classification of methods can be constructed on the basis of their principal function in the process of education. Babanskij[8] did just that and, while describing each group of methods, he chose to estimate the logical, source-generated and cognitive activities according to the different levels of pupil-initiated self-reliant activity.

Actually, he borrowed for his classification the four aspects of method from earlier collected data (cf. Tetrahedron-modelled system of methods, Šapovalenko, 1967): (a) logical-substantive, (b) source-generated, (c) educational-process, (d) organization-governing. The above aspects are clearly presented in Table 7.

TABLE 3. System proposed by Aleksiuk

Sources of pupils' knowledge (form of imparting knowledge)	Inner levels of pupils' cognitive self-reliance				
	Informative/ dogmatic	Explicative/illustrative	Problem oriented or analytical	Heuristic I	Discovery
Verbal	Verbal/informative	Verbal/explicative	Problem oriented through spoken word	Verbal/heuristic	Verbal/ task-relevant
Visual/verbal	Visual/informative	Visual/explicative	Problem- oriented via spoken word and visualization	Visual/heuristic	Visual/discovery
Work-oriented	Non-verbal/ informative	Non-verbal/ explicative	Non-verbal/ problem-oriented	Non-verbal/heuristic	Non-verbal/discovery

TABLE 4. System proposed by Ivanova

Particular methods	Universal method		
	Explicative/ illustrative	Partly-exploratory (heuristic)	Discovery
Verbal	•	•	•
Verbal/visual	•	•	•
Verbal/visual/non-verbal	•	•	•

Note: • indicates that any universal method incorporates all the particular methods on a binary basis.

TABLE 5. System proposed by Brunovt and Zverev

According to knowledge source	According to pupils' initiative level		
	Explicative/ illustrative	Exploratory/ discovery (heuristic)	Discovery
Verbal	•	•	•
Visual	•	•	•
Non-verbal	•	•	•

It follows from the above that the classification of methods developed, in historical terms, from listing to grouping. Initially, classification was based on a single principle (according to source of knowledge, teacher or pupil prevailing activity, educational goals, logic patterns, level of pupil's self-reliance in learning, degree of supervision and pattern). This was followed by constructing binary and more involved systems based upon more than two method-defining characteristics.

Judging by the evolution in the classification of methods, it is fair to conclude that the Soviet authors are striving to reflect all the multiple aspects of methods. Without going into detail about the just as many and varied (often controversial) approaches to classification, the author of the present work limits himself to noting definite progress in the theoretical understanding of method systems, the complexity of which reflect the complexity of that educative process which provides a matrix for such methods. A taxonomy worthy of that name should reflect the state of things in the theory of methods, whatever the complexity.

TABLE 6. System proposed by Lerner

Informative/incremental	Reproductive	Problem oriented	Heuristic	Discovery
I. *Teacher's activity*				
Imparting of information	Production of knowledge and guidance and supervision	Problem oriented and demonstration	Composing and giving assignments. Step-by-step programming: corrections	Composing and giving tasks. Control
II. *Pupils' activity*				
Perception, conceptualization, memorization	Reproduction of knowledge and techniques following a given pattern	Conceptualization, step-by-step solution, solution-confirmation, mental prognostication	Thinking out problem conditions, unsupervised solution. Self-control. Unsupervised motivation.	Perception or self-setting of a problem; stage-by-stage programming of search for a solution and solution techniques; searching proper and substantiation of results

TABLE 7. System proposed by Babanskij

Group I. Methods for organizing and conducting teaching-learning activities			
1. According to source (perception pattern)	2. According to logic (logical pattern)	3. According to degree of self-reliance in process of cognition (gnostic pattern)	4. According to degree of supervision (more teacher-governance or less)
Verbal/visual	Inductive/deductive	Reproductive/exploratory Exploratory/discovery, discovery	Mediated teaching, either teacher- or machine-governed
Non-verbal incl. manual training	Analytical, synthetical, etc.		Unsupervised work (using a book, written work, assignment in the lab. or workshop)

Group II. Methods to stimulate and motivate		Group III. Methods of teacher supervision and self-control		
1. Interest in learning	2. Duty and responsibility sense in learning	1. Via oral tests	2. Via written tests	3. Via laboratory assignments
Via cognitive debate; creating situations (exciting, lifelike, innovative)	Via convincing of utility; rewarding efficiency and reprimanding inefficiency	Recitation at the blackboard; testing and examining (individually); programmed recitation	Current and term tests and exams	In-the-laboratory test assignments; mediated supervision (by machine)

In further elaborating methods classification, one has to satisfy the following requirements: (a) an adequate classification should include not only methods in the universal sense, but also methods in the more particular sense of teaching specific subjects; (b) a truly valid classification should stress the adequacy of both teaching and learning methods, thus reflecting the integrity of the whole process of education which extends to the teacher's supervisory and the pupil's learning role; (c) one should not exaggerate the multiplicity of teaching methods to the point of neglecting their internal content; (d) it appears equally nonsensical to introduce too many levels in the evaluation of pupils' learning initiative unless these levels amount to a change in quality – too many levels serve solely to overshadow really essential differences; (e) the characteristics used to classify methods should be explicit enough to avoid disparity between definition and essence.

REFERENCES

1. A. Gruzdev, P.N., et al. *Pedagogika.* Moskva, Učpedgiz, 1940. 624p.
   B. Ogorodnikov, I.T.; Šimberev, P.N., eds. *Pedagogika.* Moskva, Učpedgiz, 1954.
   C. Kairov, I.A., et al. *Pedagogika.* Moskva, Učpedgiz, 1956. 435p.
   D. Lordkipanidze, D.O. *Principy, organizacija i metody obučenija.* Izd. 2. Moskva, Učpedgiz, 1957. 172p.
   E. Danilov, M.A.; Esipov, B.P. *Didaktika.* Moskva, APN RSFSR, Institut teorii i istorii pedagogiki, 1957. 518p.
   F. Golant, E.Ja. *Metody obučenija v sovetskoj škole.* Moskva, APN RSFSR, 1957. 152p.
   G. Lemberg, R.G. *Metody obučenija v škole.* Alma Ata, Kazahskij gosudarstvennyj pedagogičeskij institut im. Abaja, 1958. 93p. (Učenye zapiski, t. XXI)
   H. Kovalev, A.G., et al. *Očerki pedagogiki.* Leningrad, Izdatel'stvo Leningradskogo universiteta im. A.A. Ždanov, 1963. 312p.
   I. Ščukina, G.I., ed. *Pedagogika: kurs lekcij.* Moskva, Prosveščenie, 1966. 648p.
   J. Esipov, B.P., ed. *Osnovy didaktiki.* Moskva, Prosveščenie, 1967. 472p.
   K. Ogorodnikov, I.T. *Pedagogika: učebnoe posobie dlja studentov pedagogičeskih institutov.* Moskva, Prosveščenie, 1968. 374p.
   L. Il'ina, T.A. *Pedagogika učebnoe posobie dlja pedagogičeskih institutov.* Moskva, Prosveščenie, 1969. 574p.
   M. Ščukina, G.I., ed. *Pedagogika školy: učebnoe posobie dlja studentov pedagogičeskih institutov.* Moskva, Prosveščenie, 1977. 384p.
   N. Ogorodnikov, I.T., ed. *Pedagogika školy: učebnoe posobie dlja pedagogičeskih institutov.* Moskva, Prosveščenie, 1978. 320p.
   O. Harlamov, I.F. *Pedagogiki: kurs lekcij dlja universitetov i pedagogičeskih institutov.* Minsk, Izd. Belorusskogo universiteta, 1979. 462p.
2. Rajkov, B.E. *Obščaja metodika estestvoznanija.* Moskva, Učpedgiz, 1947, p. 149-150.
3. Verzilin, N.M. *Sistema metodov obučenija biologii.* Moskva, APN RSFSR, 1953.
4. Aleksjuk, A.N. *Razvitie teorii obščih metodov obučenija v sovetskoj pedagogike (1917-1971 gg.).* Kiev, Rodz'janska škola, 1973. 94 p.
5. Cvetkov, L.A., ed. *Obščaja metodika obučenija himii.* Moskva, Prosveščenija, 1981, p. 54-55.
6. Zverev, I.D. *Problemy metodiki obučenija biologii v skole.* Moskva, Pedagogika, 1979. 320p.
7. Lerner, I.Ja. *Didaktičeskie osnovy metodov obučenija.* Moskva, Pedagogika, 1981.
8. Babanskij, Ju.K., ed. *Vybor metodov obučenija v srednej škole.* Moskva, Pedagogika, 1981.

CHAPTER SEVEN

Systems of teaching methods and techniques

Of special importance seems to be that part of educational research which seeks to substantiate the systematization of teaching methods through feedback between methods and principles of their development, thus focusing attention on the essentials in teaching. Giving more weight to the definition and explanation of systems of teaching methods in a sense should serve to offset the somewhat exaggerated emphasis upon their taxonomy which has lately usurped the attention of methodologists. An effort to construct systems of methods by this shift of emphasis is exemplified in the research performed over a number of years by Zankov[1]. The resultant system is characterized by polyvalence (of functions, of methods and teaching techniques), procedural regularity (step-by-step introduction of prescribed operations), deliberate comparison (contrasting ideas to enhance understanding), flexibility (adaptable to particular settings and above all according to each pupil's aptitude). This approach to the identification of the essentials in a methodological system based on the interaction of methods and teaching principles appears to have gone a long way to satisfy the requirements imposed by real teaching situations where content, method, technique and form are indissolubly linked.

In practical training, three systems of methods[2] have emerged: object-producing, operational and intermediate. Certain authorities on the subject would also distinguish a technical-designing system. Each of the above systems, though following all the principles of practical training, essentially relies on one of them. Thus the object-producing system relies upon the creation of objects which gradually increase in complexity and difficulty of manufacture. The acquisition of habits of logical reasoning is a concomitant process. The operational system lays emphasis upon the acquisition of particular technical skills such as planing, cutting, measuring, joining, etc.; little or no importance is attached to the end product, its finish or its market value. The intermediate practical training system combines elements of the other two. And finally, the technical designing system stresses graphic and non-manual skills such as draughtmanship and the interpretation of working drawings, modelling and design.

In language study[3], use is made of a variety of teaching techniques loosely referred to as methods. These include direct (sub-divided into audio-lingual and audio-visual variants), comparative (developed by Ščerba) and intermediate techniques. Language teaching is fundamentally different from science teaching, yet certain methodologists tend to exaggerate its specificity claiming the non-applicability in this case of the general classifications of methods.

Certain methodologists and teachers tend to make too much of one idea to the

neglect of others and, having consolidated abstract teaching methods and thus derived some teaching techniques, claim for these latter a degree of universality. Thus, a teaching technique was devised (Kolmogorov, 1965–1975) which specified the acquisition of certain mathematical functions with the aid of number theory. Yet, too much reliance upon this technique has resulted in an unwarranted overloading of the school curriculum with mathematical theory.

Attempts at devising new approaches in this field continue. Thus, a system to teach mathematics in the fourth grade of comprehensive school comprising several approaches is now being tried out by a team of mathematics instructors from the Institute of School Equipment and Technical Aids in Education of the USSR Academy of Pedagogical Sciences. Under this system, classroom work in mathematics would proceed in two-lesson cycles consisting of: (a) a mathematical dictation exercise; (b) oral presentation of new material using visual aids; (c) analysing solutions to operations; (d) using partly-printed exercise books; (e) analysing solutions to both operations and problems (calculations, measurements, etc.); (f) exercises (unsupervised solution of problems varying in difficulty at the pupils' choice). Stress is upon teacher/pupil feedback and individualized teaching which is to be facilitated by a prompt mutual confirmation of solutions as fast as the latter emerge from the dictation exercise. Use would be made of specially designed problems encoded in the exercise books in the form of printed models, the pupils filling in the solutions. The pupils' activity and their supervision are organized by the teacher using such techniques as mathematical dictation tests to evaluate the acquisition of each segment of information in the textbook, as well as partly-printed exercise books designed to consolidate the acquisition of material, exercises varying in difficulty with individual aptitudes, and wall-charts for classroom display.

Of some concern to the classification of methods and the development of method-like systems is the term 'teaching technique' which is commonly defined in the context of educational science and methodology for particular subjects as a component of method. The selection of a teaching technique in each particular instance will be determined by the learning operations, teaching aids and other means needed to facilitate mental activity. Some psychologists and educationists tend to stress the component role of 'teaching technique' to interpret 'method' as an overall system for teaching techniques to be modelled upon. Teaching techniques are also identified with activity 'micro-elements' and thus reduced to a number of operations performed by the teacher and pupils. In other words, there is a tendency to regard teaching technique as a definite teaching/learning element in the realization of the method as a whole. Now and then, innovative teachers come up with a system of teaching techniques which contributes in no small measure to the improvement and development of methods, and to the theory of methods. Later in this book, examples of such creative effort on the part of innovative schoolteachers will be given.

There is also a tendency to group teaching techniques according to a typology. Verzilin and Korsunskaja[4] identified logical, organizational and technical approaches under particular groups of methods. Thus, under the group of oral methods, they would enter the respective logical operations (problem-orientation, definition of characteristics, making comparisons, conclusions, summarizing), organizational operations (using a written outline, discussion, planning, talking in front of

and within the class) and technical operations (asking questions by writing them on the blackboard or pointing to wall tables, circulating test questionnaires, etc.). Visual and non-verbal methods also prescribe the use of an appropriate inventory of teaching techniques.

A detailed inventory of teaching techniques may, for instance, be useful when doing an assignment in the laboratory, the techniques varying according to the conditions imposed by the experiment in hand. The work may be conducted either by the whole class, in groups or individually. The teaching material in use may be either the same for everyone or differentiated according to individual aptitudes; the same applies to the method of giving out assignments – oral instructions from the teacher, written instructions on the blackboard, cards handed to every pupil, or directions given in a textbook; material to be learned may be reproduced orally, in written form, in a diagram or by making a model.

Use may also be made of teaching techniques for such varied objectives as to motivate learning, to enhance cognitive interest, or to develop proper work habits and skills.

Soviet educationists have devised an array of methods and techniques to motivate learning. Furthermore, during the lesson the teacher can lay stress on a particular aspect of the method or technique to obtain a particular stimulating or motivating effect. Already in his introduction or while giving instructions, the teacher may highlight the cognitive significance of the material to be imparted.

Another factor in focusing the pupils' attention and interest on the material is the teacher's personal ability to put it across. Methods to motivate learning through a sense of duty and responsibility are aimed principally at orienting cognitive interest and, in the opinion of Ščukina[5], should involve: (a) a positive emotional attitude to learning; (b) cognitive interest in the emotional content of material; (c) motivation engendered by the process of learning itself. The emotional factor in creating interest is the most vital in learning, which appears to corroborate Lenin's words that 'there has never been, nor can there be, any human search for truth without "human emotions".'[6]. The methods of stimulation generally associated with human emotions presuppose the use of such techniques as: (a) creating interest-generating situations (e.g. paradox); (b) citing examples from art and literature; (c) creating situations of novelty and immediacy; (d) playing cognitive (teaching) games; (e) organizing a debate on a specific topic; (f) analysis of real-life situations; (g) creating the right atmosphere for success; (h) emphasizing the social and personal assets of learning achievement. Method-generated teaching techniques are likely to determine learning techniques. The pupil is also likely to vary his learning techniques with different assignments at every stage of the educative process.

Suppose a teacher sets his class the problem of getting their bearings in open country using a map. The pupils determine the cardinal points, mark them on the map, identify the meaning of the conventional symbols, visually survey the locality and plot their findings on the map, describe what the conventional symbols represented, and check that the map is a true reflection of the locality. The findings of psychology corroborate the usefulness of imparting study skills to pupils by gradually increasing the difficulty of assignments, which involves the transfer of acquired skills to new situations requiring new solutions – the pupil is expected to use acquired knowledge and skills in searching for a solution to a new problem,

without the teacher's help. Those interested in a more detailed explanation are referred to the curricula of the USSR Ministry of Education for 1981, which specify the minimum requirements for general and particular study skills to be imparted to pupils through the application of appropriate teaching methods and techniques.

Standing somewhat apart in the context of methods are those teaching techniques which seek to identify the essential points in the content of educational material. Such techniques are chiefly based on logical analysis. The following text reproduces a check-list whereby the essential points in any given chapter or paragraph are identified (Babanskij[7]):

I. Step-by-step identification of the main points

1. Identify the main theme.
2. Divide the text up according to themes, leaving the secondary themes to one side.
3. Identify keywords and ideas.
4. Identify the main points in preparation for a summary.
5. Prepare a summary.

II. Techniques to develop skill in identifying the main points

Selecting sub-headings, titles, writing an abstract, a précis, a summary, outlining conclusions, connecting the content with general concepts and determining its proper place in the universal system of knowledge.

III. Logical operations to identify the main points

- Analysis;
- Comparison;
- Summary;
- Debate;
- Definition and explanation of ideas.

It stands to reason that these techniques correspond to mental abilities which will impart extreme flexibility and variability, making it possible to construct a wide variety of systems.

REFERENCES

1. Zankov, L.V., ed. *Obučenie i razvitie: eksperimental'no-pedagogičeskoe issleJovanie.* Moskva, Pedagigika, 1975, p. 402-405.
2. Poljakov, V.A.; Stavrovskij, A.E. *Obščaja metodika trudovogo obučenija v starših klassah.* Moskva, Prosveščenie, 1976. 111 p.
3. Rahmanov, I.V., ed. *Metodika izučenija inostrannyh jazykov.* Moskva, Učpedgiz, 1966.
4. Verzilin, N.M.; Korsunskaja, V.M. *Obščaja metodika prepodavanija biologii.* Moskva, Prosveščenie, 1972. 368 p.
5. Ščukina, G.I. *Problema poznavatel'nogo interesa v pedagogike.* Moskva, Pedagogika, 1971. 351 p.
6. Lenin, V.I. *Collected works. Vol. 20: December 1913–August 1914.* 5th ed. Moscow, Progress Publishers, 1973, vol.25, p 112.
7. Babanskij, Ju.K., ed. *Vybor metodov obučenija v srednej škole.* Moskva, Pedagogika, 1981, p. 106.

CHAPTER EIGHT

Methods of teaching by problem orientation

The preoccupation of Soviet educationists, psychologists and teachers with problem-oriented teaching (*metodo problemnogo obučeniya)* in the past twenty years has been instrumental in collecting a vast body of applied and theoretical evidence of interest in its development. As we have mentioned earlier in this paper, problem-oriented teaching has served to enliven traditional teaching procedures considerably. In the opinion of some authors, problem-oriented teaching comprises an individual group of methods. Without undue exaggeration of the possibilities inherent in this new approach, one cannot deny its progressive nature.

By and large, in Soviet educational science, problem-oriented methods are considered as a subdivision of teaching, without being given the status of a teaching system in their own right, despite assertions to the contrary on the part of some of our foreign colleagues. Just as in the case of programmed teaching, which it is now realized has failed to justify the unreasonable expectations placed on it, today problem-oriented teaching has the unwarranted reputation by some authors of being a panacea to questions of methodology. Furthermore, routine questions and routine scholastic assignments are sometimes erroneously regarded as problem-oriented exercises. At the opposite extreme, and just as erroneously, artificial problems are set which are obviously beyond the capacity of the pupil, whose still immature mentality and experience are anything but sufficient to find a solution.

Misinterpretation and misuse of problem orientation and problem-oriented techniques have resulted in an intolerable waste of school time and a simply ridiculous level of failures. However, this exaggerated and frivolous approach to problem orientation is not evidence of its complete uselessness, since it is certain to bring about improvements in methods by encouraging self-reliance in the pupil, provided it is used with discretion and not to the exclusion of the established standards. Neither should one ignore the connection between methods and the content of education, which is subject to restructuring to align with problem-oriented situations. This is precisely in the spirit of the current objectives of education and upbringing.

Prior to an analysis of the characteristics of problem-oriented teaching methods, it appears advisable to survey in brief certain psychological aspects of teaching by problem orientation. These aspects have been studied in-depth by Matjuškin[1], whose findings provide grounds for a theoretical study of the problem[2].

Proceeding from the premise that intellect can only develop by overcoming problems, Matiuškin stresses the role of personal needs as the prime source of

psychical development. The creation of purpose-oriented conditions should create personal needs for learning, the satisfaction of which is associated with the acquisition of ways of conduct and thinking. It is the situations creating a need for reasoning processes that Matjuškin labels as problem situations or settings.

Rubinštejn tends to perceive in a problem situation a first step to reasoning. In the schoolchild's mind the cognition of the unknown is a discovery he makes in the process of transforming a teacher-constructed situation into a finality which should conform to the conditions of the problem set. The difficulty of problem orientation lies in having to conceptualize the unknown, something yet to be learned, since the capacity for such a conceptualization varies with different pupils, meaning not only their creative abilities as such, but also the level of knowledge, skills and useful habits they have acquired.

It is in view of all this that the author of the present book proposes to divide the problem-oriented approach into three components: (a) the necessity of performing an action created by a new unknown relationship, technique or condition; (b) the occurrence of an unknown which is to become known in the problem-oriented situation; (c) the pupil's capacity to cope with the assignment, to analyse the situation and to discover the unknown. If the assignment is neither too difficult nor too easy a problem-solving situation exists[3]. The degree of difficulty of the assignment and the sequence of actions necessary to bring about its achievement are closely connected with the assigned goal and the working abilities. Especially notable is the emergence of a pattern from the experience gained in fulfilling previous assignments, a pattern to be applied to the conditions of a new problem-oriented situation in the manner one overcomes a psychological barrier. This is not possible unless the pupil has the capacity to transfer the experience already acquired into a new matrix of interconnections.

The sequence of problem-oriented situations is also important. Thus, a pupil learns to multiply and divide only after he has learned to add and subtract, which marks a transition from simpler to more complex operations depending on the acquisition of new abilities. A problem-oriented sitation may be used to introduce new material or, in the following stages, may serve as a principal ability used to learn new material or abilities, to evaluate and confirm the results of education or upbringing.

Psychologists wisely drew attention to the misconception in problem-oriented situations of offering historical examples of scientific discoveries as a pattern for their pupils to follow in their own learning effort in the classroom. It would be erroneous to try to reduce problem-oriented teaching to a mere reproduction of what once occurred in the history of science and society. It would appear just as erroneous to downgrade the function of knowledge acquisition in problem orientation, which is anything but insignificant, or to downgrade the role of abilities to acquire knowledge and problem-oriented techniques (study skills and habits).

However, the role of problem-oriented teaching in combating the passivity of methods and the one-sided intellectual approach to teaching has been widely recognized. In junior school forms, problem-oriented teaching plays the role of a learning stimulator, while at the senior level problem orientation reaches the level of a research activity in its own right.

Whilst applying problem-oriented situations to teaching, it is important to be

aware of the degree to which the pupils appreciate the validity of the problem which is set in the form of a question or task. In teaching, problem-oriented situations may play the principal or an auxiliary role. But the main difficulty for the teacher is in the way he imparts instructional material as a sequence of problems to be solved ('discovered') by the pupils themselves.

Both psychologists and educationists have advanced convincing evidence to substantiate the effectiveness of problem-oriented teaching which, among other things, serves to develop intellectual activity in the pupils, their capacity to understand and to reason.

Some educationists tend to oppose problem-oriented teaching in favour of conventional methods. Yet, it would be more appropriate to stress the positive aspects of conventional methods, provided they do not resort to dogmatism, recondite scholastics or cramming. It would be more appropriate to draw upon the positive experience of the past, while correctly integrating this heritage with new trends such as, for example, problem-oriented methods. Thus, the good old heuristic question-and-answer dialogue has not yet been relegated to the past, even though it has been known from the times of Socrates and Plato. Furthermore, today it forms an essential component in avant-garde methods which come close to problem orientation.

Even today debate continues on how to define problem-oriented teaching. The recently introduced concept of 'the problems principle' has not removed the ambiguity. Problem-oriented teaching is either reduced to the solving of cognitive problems or to a teaching method (or a group of such methods). In an attempt to expand the notion of problem-oriented teaching to the degree of a teaching system, Mahmutov is seeking to introduce an altogether new concept of 'problemizing-for-mental-development' teaching.

It appears more logical to define problem-oriented teaching as a particular system of methods and techniques which relies upon the appropriate configuration of educational content and the stimulation of the pupils' initiative in finding solutions. Thus, the technique so popular with Soviet teachers of getting the pupils to study the growth of farm crops is a typical case, for in the process of learning they have to solve for themselves a number of consecutive agricultural problems. Even though the pupils working on agricultural experimental teams are actually striving for higher yields, their work contains an element of discovery through the staging of experiments. On the basis of preliminary measurements of air humidity and temperature, soil moisture content and other soil parameters, the pupils clarify a problem by themselves (the goal of the experiment), i.e. what should be found out, which of the many factors needs verification (the optimum choice of crops, the condition of soil, irrigation requirements). Once the problem is clearly specified, the pupils can decide how to draw up a plan for an experiment involving the methodical identification and choice of variables, drafting a schedule of operations, deciding on what equipment they need, how best to organize work, how to transfer their plan from paper to the land, monitoring and recording observation data, and summing up the results with a view to using some of the experience in the future.

Another worthy project for schoolchildren is aimed at finding out the historical background of the locality they live in, or the farm or factory where their parents are employed. Quite a few schoolchildren collect and catalogue materials concerning

the Second World War, help organize permanent exhibits featuring the exploits of local people in times of war and peace, and sometimes organize their own exhibits devoted to the life and work of Lenin and the history of the Communist Party.

For example, in the village outside Moscow where Lenin spent his last years, the local schoolchildren have organized a sort of club where they get together and hold activities based on Lenin's life and work at a level which can be described as truly problem oriented and even scientific. The schoolchildren of the village have managed to unearth numerous documents and artefacts relating to the foundation in 1924 by N.K. Krupskaja (Lenin's wife) of the local school. The wooden building which used to be used as a school for the children of poor peasants has now been restored, converted into a museum and placed on public display inside the new school building. The local children have been guided in this project by a panel of experts from the Institute of General Educational Problems of the USSR Academy of Pedagogical Sciences. The project has become a focal point of social activities for schoolchildren and teachers alike. It is worthy of note that the children are given a free hand in deciding which artefacts are to be collected, which surviving eye-witnesses of Lenin and Krupskaja are to be invited to their school to speak, and how best to organize the museum and thus preserve the memory of the man who founded the USSR.

All these examples testify to the fact that the problem-oriented method is not restricted solely to instruction, but may be used to teach how to do scientific research. As for study in the classroom, the problem-oriented approach essentially involves the following teaching stages:

1. Observation and factual analysis;
2. Identification of the unknown (problem orientation);
3. Speculation, formulating a hypothesis;
4. Working out a search plan for finding a solution;
5. Carrying out the plan systematically;
6. Drawing links with similar problems;
7. Data processing; substantiating and formulating the solution;
8. Verifying the solution; corroborating and clarifying the data collected in the search process;
9. Conclusions and recommendations; possible application of the findings as well as prospects for new projects.

This is an outline of how the pupils search for an answer to the problem which they have identified by themselves. The teacher's role is reduced to the imparting of knowledge about general approaches and working methods. It is also incumbent upon the teacher to select carefully a system of problems on an ascending order of complexity. The teacher also retains the function of ultimate control and, if necessary, of assistance in the form of advice or recommendation to redirect or restructure the search, etc. It is the teacher who initiates the summing up of results and subsequent discussion.

Special care should be taken to divide the search up into stages, since more often than not the pupils find it impossible to view the problem in all its complexity and therefore cannot properly apportion activities for its solution. In order to have them solve the problem, the teacher leads the pupils on to its solution methodically, training them to identify the components of the problem, to base their answers on

reliable evidence, to arrive at conclusions by examining the facts, to draw up a plan of operations, to come up with a hypothesis, and finally to arrive at a solution.

This process of solving problems has been designated the heuristic method by Lerner[4,5], since it often assumes the form of a heuristic dialogue. According to this method, it may also be the teacher who sets a problem, identifies the contradictions, formulates the separate tasks (sub-problems), and guides the pupils to a solution. Thus, in the course of the heuristic dialogue, the pupils participate in the search by expressing opinions to be accepted or rejected by the teacher. This 'partial' search technique plays an auxiliary role in preparing the pupils for the definition and explanation of a problem.

There is considerable room for improvement in teaching the natural sciences by problem-oriented techniques, since laboratory assignments are often given in the form of known facts which the pupil is asked merely to confirm by experiment, instead of attempting to find solutions to these problems for himself. For instance, problem orientation could be applied in this particular case in an experiment to identify the conditions of starch formation in green leaves. The teacher highlights the discovery by Joseph Priestley of the ability of green plants to purify contaminated air by absorbing carbon dioxide and releasing oxygen. Next he sets up equipment to recreate the conditions of this experiment. The actual problem orientation itself is preceded by the pupils conducting tests to reveal that the availability of light is one of the essential conditions for the decontamination to take place. Now the problem is to compare the changes that take place in a leaf in the light as against one in the dark. The pupils put forward suggestions to explain the effect of light on the processes inside the leaf. Appropriate tests are performed. Recalling that starch turns blue in iodine solution, the teacher proposes to begin the next stage of the experiment to detect starch by eliminating the green colouring of chlorophyll. On being immersed in alcohol the leaf loses colour and the pupils are now able to detect the presence of starch by putting the leaf in iodine solution. By comparing this phenomenon with that of the leaf kept in the dark, the pupils are able to make 'their own' conclusion about the formation of starch in a leaf exposed to light.

Thus, the pupils are guided to discovery through a series of tests they have to perform themselves, and a heuristic dialogue. The educational value of teaching a biological experiment by problem orientation is much greater than using an experiment merely to confirm a piece of knowledge imparted second-hand as, for example:

> Joseph Priestley showed that a green peppermint branch is able to purify air [referring to the well-known peppermint and mouse experiment], that it releases oxygen in the light and carbon dioxide in darkness [proceeds with experimental confirmation]. A green leaf on exposure to light forms starch [referring to the experiment results].

This version resorts to an experiment merely for illustration and not for developing in the pupils a sense of search and discovery.

In problem-oriented teaching, the teacher can also rely on a purely oral medium. He would then seek to survey a given problem in terms of its history, evolution, or in terms of the logic for finding a solution, naturally keeping his presentation as concise as possible. Alternatively, he can employ the modern scientific technique of

proving one's point by confronting opposing views until one isolates a truly convincing argument. It is the teacher who sets the pattern of logical discussion and proof for the pupils to follow.

The structure of a problem-oriented discussion may be presented as follows:

1. The teacher sets a problem drawn from the history of science or modern experience;
2. He initiates a logical discussion in the search for a solution;
3. He confronts contradictory viewpoints in the search for convincing arguments towards a solution;
4. He makes the pupils prove their points;
5. The class debates the theoretical and practical prospects for an in-depth study and further development of the problem in hand.

To acquire the habits of problem-oriented reasoning, the senior students may be referred to such popular science writers as Makh, Landau and Timiryazev. A good illustration of the problem-oriented approach can be found in Lenin's speech on government, which, by the way, is studied in the tenth-form curriculum. In Lenin's opinion, problem-orientation can be very instrumental in making science truly popular, since ...

> The popular writer leads his reader towards profound thoughts, towards profound study, proceeding from simple and generally known facts; [he] arouses in the mind of the thinking reader ever newer questions. The popular writer does not presuppose a reader that does not think; on the contrary, he assumes in the undeveloped reader a serious intention to use his head and *aids* him in his serious and difficult work, leads him, helps him over his first steps, and *teaches* him to go forward independently. The vulgar writer assumes that his reader does not think and is incapable of thinking; hands out 'ready-made' *all* conclusions of a known theory, so that the reader does not even have to chew but merely to swallow what he is given[6].

In a problem-oriented presentation, the teacher makes wide use of quotations from literature, tables and diagrams displayed on the blackboard, tape-recordings, film-showings, experiments, etc. Problem orientation stands much to gain from imparting scientific knowledge in a graphic manner thus making teaching methods into something better than simply a rubber-stamp of ready-made formulas.

Educationists no longer doubt the effectiveness of teaching by problem orientation. As we have already said, the scope of application of such methods depends on more than one factor. Problem-oriented teaching methods grow in sophistication and complexity with the development of the pupils' knowledge and experience.

REFERENCES

1. Matjuškin, A.M. *Problemnye situacii v myšlenii i obučenii.* Moskva, Pedagogika, 1972. 208 p.
2. Mahmutov, M.I. *Organizacija problemnogo obučenija v škole: kniga dlja učitelej.* Moskva, Prosveščenie, 1977. 240 p.
3. Ibid., p. 34.
4. Lerner, I.Ja., ed. *Poznavatel'nye zadači v obučenii gumanitarnym naukam: kollektivnaja monografija.* Moskva, Pedagogika, 1972. 239 p.
5. Lerner, I.Ja. *Didaktičeskaja sistema metodov obučenija.* Moskva, Znanie, 1976. 64 p.
6. Lenin, V.I. *Collected works. Vol. 5: May 1901–February 1902.* 4th ed. Moscow, Progress Publishers, 1964, p. 311–312.

CHAPTER NINE

Variety and specificity of teaching methods

Teaching methods for particular subjects derive from basic educational principles. Basic educational principles also underlie the development of those methods which are essentially non-specific, common to all subjects, and they serve to determine basic trends in the improvement of teaching methods. Compared to these principles, methodology is more responsive to the specific content of particular school subjects. There are obvious differences between methods to teach mathematics and music, biology and physical culture, practical training and literature, etc. Reflecting the ongoing trends in basic educational research, teaching methods provide scientific foundations for and bring the teaching of each particular subject into line with the corresponding branch of science, technology and culture, as well as with current social demands. Therefore, a very wide variety of methods are available. The characteristics of particular school subjects call for a regular updating of teaching methods.

The wide variety of methodologies does not exclude the existence of methods common to all subjects and groups of subjects. An analysis of reference books, monographs, articles, proceedings of educational conferences[1-11], and teachers' day-to-day experience is evidence of a definite trend towards activity methods in the pupils' learning participation in the teaching of all subjects. Recent research has been of indisputable value in the renovation of methods. Teaching methods are now defined according to their cognitive activity rather than by their outward characteristics[12].

Table 8 lists school subjects according to the major sub-divisions which will be associated with particular teaching methods in the following sections.

Humanities

A typical feature of methods to teach the humanities is reliance upon an oral presentation, which in this instance serves both as an object of study (learning) and a technique of study.

Language study does not follow the structure of science teaching but rather takes the form of a practical course to which language aspects, such as grammar, phonetics and vocabulary, are subordinated, whether the study concerns the mastery of the mother tongue or the acquisition of a foreign language. In the initial stages of learning to read and write and introducing grammar there is a tendency to deviate from a purely didactic approach, with its somewhat dogmatic characteristics, in favour of the heuristic (inductive) method. This latter has recently ramified into

TABLE 8. Major sub-divisions of school subjects according to teaching method

Humanities	Natural and exact sciences	Manual training	Physical training	Arts subjects
Literature	Mathematics	Draughtsmanship	Physical culture	Singing
Languages	Physics	Manual labour		Music
History	Chemistry	Socially useful work		Drawing
Civics	Biology			
Social science				
Geography				

problem-oriented and search-and-discover methods. Each of these has its own particular characteristics. Thus, among the methods used to study Russian, it is perfectly usual to adopt an analytic-synthetic method for each aspect of study. These variations include: (a) getting the pupils to observe language phenomena; (b) to perform language analysis; (c) to imitate particular speech patterns; (d) both with the teacher and individually to compose speech units to emphasize and identify definite language phenomena; and (e) to give examples in the various styles of literary Russian.

A special function of language-study methods is to correct the pupil's pronunciation, thus facilitating his ability to communicate through language. For this purpose, use is made of specially selected texts, pupils' essays, oral presentations and individual suggestions in the classroom. The pupils are encouraged to give a linguistic criticism of one another's written and oral contributions. Another worthy innovation is the practice of compiling exercises based on the content and form of written or oral material acquired, depending on the environment and teaching aims in hand. An exclusive role in language study is played by the teacher's personal eloquence (consistency, precision, expressiveness, forcefulness, flexibility) as an example for the pupils to follow in mastering the language.

The recent findings of educational research have prompted Soviet methodologists to introduce new teaching methods which have been specially adapted for the study of foreign languages:

1. An explanatory-illustrative method;
2. The reproduction of non-variable units;
3. The acquisition of speech patterns in non-variable situations;
4. Reproducing variable speech patterns;
5. Building up speech patterns in variable situations;
6. A productive-search speech activity;
7. An incremental-search speech activity.

However, this system of methods is not universal; other systems have been gaining ground as well. One of them would divide methods into three groups each reflecting a particular mode of teacher/pupil activity: (a) an explanatory-communicative and reproductive mode; (b) an instructive-practical and self-educational mode; (c) a motivated/practical and creative mode. Yet another method relies upon the linguistic analysis of patterns of language phenomena in the mother tongue or, as the case may be, a foreign language.

As far as methods to teach literature are concerned, one can observe an obvious 'retreat' from the analysis of literary works in a purely logical and analytical fashion in favour of a more broad aesthetic understanding. Today, one is likely to combine a wide variety of techniques in the teaching of literature, both informative and creative – such as a study of the author's biography, the historical background to a given literary work, as well as the acquisition of certain creative skills (explanation of new words, expressive reading, précis-writing, etc.). All these techniques serve to enhance the pupils' aesthetic criteria.

Literary and aesthetic senses are also awakened by analytical reading, by essay writing, and by encouraging the pupils to voice their own criticisms of a book. In the initial stages of an introduction to literature one is well advised to encourage the reader's independent choice and interest in reading, especially of fiction and poetry.

The motivation of reading effort should be accompanied by the acquisition of specific literary knowledge.

The understanding of a literary text should have three guidelines: plot, characterization and events. This will depend on the pupils' level of literary development. Some may carry out their assignments under supervision after an introductory explanation by the teacher, while others can work independently. As a rule, to begin with, the pupils are assigned reproductive tasks (retelling, copying) and only after such preliminaries are they given a chance to display more creative initiative and try their hand at the various forms of essay writing.

The study of social science subjects commences with simple examples from the country's history. To make things even easier, at the beginning one may rely upon local material to illustrate certain points of national history. At this stage it is very important to distinguish between the particular and the universal. It is just as important to develop in the pupils an awareness of historical events occurring in space and time, to proceed, as it were, from the locality to the nation, i.e. from the history of, say, a particular region or republic to that of the entire Union of Soviet Socialist Republics. The history of nations, their cultural traditions, their fight for freedom and independence are an important source to draw upon in inculcating patriotism, respect for other nationalities, and to strike a correct balance between patriotism and internationalism. From the very first days of school it may be advisable to resort to such simple yet effective techniques to stimulate the study of history as visual aids, maps and diagrams, getting the pupils to retell appropriate passages from textbooks as well as organizing excursions to the local museum, getting the pupils to assemble various exhibits featuring Lenin, and the feats of local citizens in times of war and peace.

For teaching ancient and mediæval history teachers may rely upon official textbooks which have received State awards. They not only merit the awards but also have definite advantages from the methodological point of view in that they present assignments and questions in a concise manner, while exercises are carefully coordinated with the texts and illustrations.

Yet, even the best of textbooks cannot replace the teacher's vivid and graphic presentation. In the study of history, as in other branches of teaching, there is already considerable experience in problem-oriented methods to make historical events more explicit, to develop in the pupil an awareness of the influence of socio-historic laws and, last but not least, to reinforce speculation with fact. The graphic method of presenting history is thus applied in association with social analysis and explanation. Just as powerful a stimulus to develop historical reasoning in the pupil is offered in the form of anthologies, slides, films and historical maps. The essentials of techniques to study history may be summarized as the correct blend of image and spoken word, the relationship of historical concept and fact; the presentation of historical fact in terms of space and time.

In some schools models are made of cultural and architectural artefacts from different historical periods. To make the pupil aware of the phenomenon of historical time one should rely on chronological tables. A no less powerful motivation to learn history is to read popular historical journals. The advantages to be gained from historical maps, documents and the accounts of archaeological discoveries from textbooks and other sources are truly limitless.

In the senior school, the study of Soviet history is followed by that of modern world history. At this level, more frequent recourse is made to unsupervised research, advancing hypotheses with a subsequent substantiation with appropriate textbook passages or historical documents, atlases and the filling out of sketch maps.

The Soviet school has considerable experience of the study of Marx, Engels, Lenin, official publications of the Soviet and other Communist and Workers' Parties, the works of Brežnev and other Party and State leaders (popular versions of this literature are selected for school use). Every upper secondary student has at his disposal a detailed reference list of Marxist-Leninist classics. Each congress of the Soviet Communist Party is followed by the publication of a manual for the use of teachers. At regular intervals the methods to teach Marxism-Leninism in school are revised by national conferences. All this contributes to the teaching of socio-historic and other subjects in Soviet schools at a high ideological and theoretical level.

To reinforce the pupils' logic and conviction the teacher has to make sure that upper secondary students know how to do précis-writing and to abstract literature, to use filing systems, bibliographies, background papers and reference books. Training pupils to benefit from historical maps, tables and diagrams also serves the same purpose.

As far as the teaching of civics is concerned, special mention should be made of a recently introduced course on the principal theme of the 'USSR Constitution'. In teaching this subject, use is made of case-study cards presenting accounts of human situations which have moral and legal educational value. The pupil is required to analyse situations which are taken from press reports or fresh from the day-to-day life of the local community. Much is gained by staging in-class debates on legal issues. Such debates – typically concerned with a contemporary topic – require the ability to summarize, and a thorough knowledge of other school subjects and background in theory and philosophy. The content determines the form of teaching. Wide use is made of a lecture or a narrative based upon the adoption of a point-of-view and the presentation of evidence. In the study of civics, the pupils acquire increasingly complicated intellectual abilities which enable them to make individual, particular and universal judgements needed to explain the typical and generic characteristics of social phenomena.

Audio-visual aids used for studying this subject, in the form of films, tape recordings and telecasts, are chosen on the basis of pertinence, reproductive precision and authenticity.

To facilitate the learning of the basic socio-economic developments of our time, increasing use is made of interviews and encounters between the pupils and successful workers and engineers, some of them members of local councils. The lessons on socio-economic themes are also conducted in the form of tutorials, debates and conferences. In this area of teaching, frequent recourse is had to Communist Party periodicals, Marxist-Leninist works and press reports. The senior students organze and attend in-school socio-political events, such as Young Communist League meetings, all-school debates, question-and-answer exchanges and talks on current events.

Another type of socio-political activity undertaken by the pupils and which deserves mention is work on collective and state farms, building sites and in fac-

tories. All this contributes to a higher social awareness of the pupils who are learning to insert themselves into Soviet society and thus to share with other peoples the hope for lasting world peace.

Natural and exact sciences

The development of methods to teach mathematics depends to a considerable extent on the general concepts underlying the structure and selection of mathematical knowledge and the techniques of imparting that knowledge. In summing up the consequences of the introduction of new content in mathematics, the reliance on number theory was found to be exaggerated. Emphasizing the pupil's mathematical versatility and linking mathematical instruction with daily life has made it imperative to simplify mathematical terminology and definitions. Greater stress has been placed on axiomatics and learning the grammar of mathematics for the purpose of applying theory, axioms and formulae to the solution of problems in an ascending order of difficulty. In view of the above, stress is now laid on teaching the pupil to carry out simple calculations, measurements and structures. Simple and logical mathematical demonstrations are combined with exercises in problem orientation, proving mathematical propositions, mental arithmetic, draughtsmanship and plotting graphs. Assignments performed in the laboratory or workshop, including detailed drawings on paper, the making of machine elements and cartography, have now been placed on a more practical footing. The acquisition of all these abilities is followed up by the preparation of diagrams and modelling.

The first efforts have been made recently to introduce micro-calculators as an aid to mathematical instruction. However, their use is restricted in order to avoid any impairment to the children's natural ability to do mental arithmetic, essential to the solution of particular mathematical problems. Discrete use is also made of programmed-instruction methods involving punched cards and tapes, as well as unsophisticated electronic teaching machines available in schools. The use of teaching machines enables the user to reinforce his understanding of theory and also serves to facilitate the unsupervised analysis and solution of problems.

The study of mathematics is an important contributing factor in the development of such logic-based teaching methods as induction, deduction, abstract modelling, analysis and synthesis, i.e. methods associated with such exploratory mathematical teaching techniques as experimentation, observation, comparison, analogy, intuition, etc. Combining oral-symbolic and visual-graphic factors presupposes the use of narration, explanation and discourse with reliance upon appropriate teaching aids. To stimulate the pupils' awareness of the role of mathematics in daily life, of the purpose mathematics serves in understanding the reality, the teacher gradually introduces such methodological concepts as fundamentals, demonstration, axiom, theorem, truth and, at the same time, describes the conditions under which abstractions, rules, formulae and the properties of geometrical figures are applicable.

Recently a new method has emerged in geometry which stresses succinctness in imparting axioms, exactitude in mathematical demonstration, and connecting up axioms with applied geometry.

It has been found useful to develop major abilities in geometrical reasoning from an early age. Transition in one's mind to definition and explanation is based upon

the identification of what really matters to the exclusion of what does not. If attention is directed towards the basic essentials and if increasing reliance is placed upon clarity and logical consistency, the pupils' ability to learn mathematical language and their powers of reasoning will benefit. Mathematical abstractions are typically translated into the language of spatial vision in the form of drawings, diagrams, dynamic models to stimulate the development in the pupil of a concept of geometrical space. This enables the pupils to perceive the material substance of mathematical formulae obtained through the logic of demonstration, since in 'real life... logical forms and laws are not merely an ephemeral structure, but a reflection of the objective reality'[13].

In mathematical teaching methods, there is a particularly strong tendency to theorize and to pinpoint the universal, generic nature of objects. In terms of method, this tendency has been codified by Erdinev[14], who has devised a set of teaching techniques by combining units to be learned into larger groups and mutually opposing mathematical operations (addition and subtraction, multiplication and division, direct and inverted problems). Polar opposites, when compared, help to facilitate the learning of a part through the whole, to effect analysis through synthesis, to understand a structure through its function. This approach to the teaching of mathematics is an indication of complementarity. It is on this principle that Erdinev has developed the content and methods to teach mathematics in primary school.

A noteworthy study was carried out by Zenkovič on the multi-purpose application of teaching techniques and their various combinations[15]. He identified three groups of teaching techniques: I. Heuristic dialogue: open debate, solving problems using a drawing, reading graphs, compiling a mathematical glossary, reading a story to illustrate a point from the history of mathematics, drawing a diagram to prove a theorem, modelling, comparison, examples to the contrary, summaries; II. Techniques to develop the promptness of application of mathematical concepts: using punched cards; making up an algorithm; problem solving (demonstrations of theorems, proving an identity); mathematical relay; diagrams; using mock-ups; stereometric boxes; mathematical quizzes; mathematical lotto; mathematical précis-writing and plotting 'fulcral' diagrams; proposing game situations (contest for the best mathematician in the class, etc.); III. Memorization techniques: by reciting in chorus rules and properties; theoretical presentation; calculating 'out loud'; problem-solving and theorem-proving; mathematical dictation exercises; reviewing other pupils' work; inventing control problems; questioning pupils; working with a textbook; mutual control of calculations by the pupils themselves. It was also decided that the most effective methods combined between three and six techniques per lesson. Difficult tasks should be undertaken at the beginning of a lesson, with less difficult but longer ones being put off towards the end. The sequence I–III–II was found to be the best.

Specific to mathematics teaching is a regular cycle of tests which should meet the following requirements: moderately difficult, objective, valid, reliable, concise. Assignment cards to specify systematic operations for the pupil to perform are becoming increasingly popular. The way the task is divided up on the assignment card not only guides the pupil from operation to operation, but also provides a general pattern for him to follow in order to solve the problem. Characteristic of

mathematics teaching is a reasonable combination of the axiomatic and the empirical, the provable and the plausible. A precise structuring of mathematical knowledge undoubtedly makes for an orderly use of the various methods and techniques available to the teacher.

Related to the methods of abstract logic used in mathematics teaching are the general laws used to teach such sciences as physics, chemistry and biology. The tendency to define universal laws and theories is responsible for the mathematical approach to these subjects in general and their teaching in particular. This is true, above all, of teaching physics, and to a lesser degree of chemistry and biology. Many principles, laws, definitions and units of measurement can be expressed in terms of common mathematical abstractions, formulae and symbols. It seems reasonable to develop a unified system for the expression of formulae and letter symbols. The expression of a physical law in a formulae is based upon abstract mathematical terms reflecting the objective reality of nature. The application of mathematical methods in the teaching of chemistry and physics will depend for their success on the correct systematization of analogous phenomena and objects, on the faithful perception of their similarities, and on systematic procedures in techniques of formalization.

Methods to teach natural sciences have the following elements in common with ordinary nature study: (a) the identification and analysis of the pupils' everyday views; (b) transition from everyday views to scientifically substantiated concepts; (c) incorporating a newly acquired concept into a system of previously acquired concepts; (d) consolidation of acquired concepts and their application in new authentic situations. Typically, methods to teach physics, chemistry and biology reflect research techniques which are usually distinguished between theoretical and empirical. Thus, the following research methods are likely to be reflected in methods to teach physics: *I. Theoretical*: (a) point-by-point (analytical); (b) continual (field theory); (c) point-continual (electron theory); (d) systems analysis (thermodynamics); (e) statistical; *II. Experimental methods*: (a) observation; (b) measurement of physical values; (c) calculating the influence of physical values; (d) preparation of objects (monocrystals, films, isotopes, etc.)[16,17].

Recourse to research methods in developing teaching methods involves: (a) a precise identification of scientific principles, following the pattern of scientific discoveries made in the past; (b) the qualitative and quantitative definition of principles; (c) experimental corroboration of a scientific theory; (d) identification of the terms of reference of a scientific theory; and (e) the use of scientific theory as a cognitive method in teaching situations. The application in school of scientific, theoretical and empirical methods comprehensible to the pupils serves to develop their search-and-discover abilities, teaches them to formulate an initial working hypothesis, to select the method and interpret the results. The application of scientific methods in imparting knowledge has a beneficial effect on achievement, provided conditions incite the pupils to search for a solution along scientific lines in an endeavour of creative guided-discovery.

An effective way to combine theoretical and empirical procedures would be to have the pupils invent and solve by themselves problems which depend for solution on the formulation of a fundamental initial concept, logical exercises, mathematical operations, and experimentation in the field of natural science. One of the textbooks

used in physics (Razumovskij[18]) contains a comprehensive system of creative problems presupposing a sequence of initial data, abstract models (hypotheses), theoretical results and experimentation. The content and parameters of the problems require a complex analysis of many organic and inorganic phenomena, and thus provide a stimulus to establish interdisciplinary connections. The problems presented for solution may reflect socio-economic issues, scientific and technological developments, the pupils' practical activities, their observations of nature, facts borrowed from literature, films, the biographies of outstanding scientists, accounts of significant discoveries, examples of the application of physical laws in medicine, biology, chemistry, etc.

A specific technique in the teaching of physics and chemistry is the preparation of diagrams to stimulate the pupils to adopt logical procedures in order to learn complex pieces of scientific knowledge. The construction of an abstract model may involve such operations as repetition of acquired material and its development, conclusions, the introduction of a concept, the construction of a concept, its definition and application, and outlining other possible applications. A model in the form of a graph or a schematic diagram should be succinct, coherent and of wide application as well as reflecting habitual associations and stereotypes (symbols). Diagrams may cover a unit in a textbook, a lesson or part of a lesson; they can include an experiment on theoretical material of a universal nature or be based on pure experimentation. Experimentation in teaching the natural sciences may provide a basis for the development of other teaching methods and techniques which have different applications in the teaching process.

Demonstration experiments, which are applicable to the teaching of physics, chemistry and biology, are, of course, widely used. Techniques to demonstrate physical, chemical and biological phenomena are thoroughly familiar. However, the demonstration experiments for each school subject have their own characteristics and involve the use of specific experimental technology. Modern technical devices such as microscopes, various kinds of filters and measuring apparatus are especially useful whenever they help attain clarity, vividness, contrast and impact in staging demonstration experiments. However, in chemistry safety precautions should be strictly observed since experiments may involve the release of dangerous substances, some of them explosive.

Film and slide showings are just as useful in teaching the natural sciences. The purpose-oriented and problem-oriented character of audio-visual presentations (not merely illustrative) help the pupils to perceive the essence of the matter, visualize in life-like terms the state of a physical body or a process under study in experimental conditions, i.e. to compare the initial and subsequent state of a body, a substance, a living organ or an organism. The purpose of audio-visual demonstration is to give the pupils a chance to see for themselves the essence of the problem and to find a solution to it.

From the point of view of application, the teacher's skill can be measured by his ability to show the pupil how and why the object or the process under experiment is transformed at every stage by his ability to focus attention on the essentials. The dynamism of an experiment, no matter how difficult to attain, is the most effective feature from the educational point of view. The impact of an experiment is measured by the extent (qualitative or quantitative) to which the experimental object or

phenomenon can be seen before and afterwards in comparable conditions. No less important is the accuracy of the conclusion as to the cause of the changes which have taken place as a consequence of the experimental conditions. A faithful account of these conditions is an essential contribution to the value of the experiment. Only an experment which meets these conditions produces results which can be analysed, discussed and explained for instructional purposes.

Educational experiments are based on the same principle as scientific experiments, i.e. the human mind is striving for the unknown, something to be discovered. The difference lies in the availability of equipment in the school and the pupils' capacity to undersand – simplicity meaning not only technology but substance as well. It is obvious that not all scientific experiments are suitable for demonstration in school.

Biological experimentation is fraught with particular difficulties, since living objects require special care. Quite a few experiments with plants, animals and microbes take longer than one lesson. In such cases, the experiment is set in motion either by the teacher or a group of pupils beforehand, monitoring is maintained in out-of-class time, while the final results are recorded and debated in the class.

Standing somewhat apart, from the point of view of methodoiogy, are extra-mural experiments conducted on the school experimental plot or on a nearby collective farm. There are two aspects of agro-biological experimentation: (a) a 'task-relevant' method of introducing an experiment to identify (or consolidate) a definite piece of biological knowledge; and (b) the practical application of the experiment which is designed not only for instructional purposes but also to meet the needs of actual production (e.g. to determine the optimum crop variety under existing conditions, the composition of fertilizers to obtain the highest possible yield of a given crop, the most rational schedule for top-dressing and irrigation, etc.).

The proper place for task-relevant experiments is the school laboratory. Even though this procedure is applicable to all subjects in the group, chemistry teaching is likely to gain more from qualitative experimental tasks which are intended to develop the pupils' comprehension and to confirm and evaluate the acquisition of concepts. Thus, experiments in chemistry are not only resorted to during normal lessons, but also at exam time. The experimental tasks are co-ordinated with the teacher's oral presentation, with the heuristic dialogue, with what the textbook says and, last but not least, with what one finds in reference books, background documents and other sources. Some of the experiments derive from allied natural and exact subjects. Agro-chemical experiments are typical in that they serve to determine such production-oriented parameters as soil acidity, soil humus content, and the analysis of fertilizer, which involves dosing applications and understanding the composition of organic compounds in the crop or in parts of the crop.

Observation is also a method to study natural objects and phenomena, comprising either the whole or part of an experiment. Observation serves a definite purpose, is conducted in stages and pre-supposes continuity. The structural components of observation, besides serving the original purpose, gradually grow in complexity thus making for greater self-reliance. Rute[19] has advanced the following description of the structural components of observation. 1. Define a tack that requires observation: (a) introduce a problem, put forward a solution (purpose and necessity of observation), understanding the object of observation; (b) define the scientific

purpose (together with the instructional purpose); (c) fill in background knowledge about the object to be observed, the acceptance or rejection of the original scientific purpose and/or substituting a new purpose; 2. Plan observations: (a) identify conditions (selecting equipment, location and techniques); (b) draw up a plan; (c) select a way to record data (oral description, drawings, tables, etc.); 3. Conduct observations: (a) carry out operations (comparison, measurement, etc.); (b) encode and record; (c) precision control, verification, comparison of individual data; 4. Process results: (a) decode, summarize conclusions; (b) compare results with the original purpose and definition.

In the process of carrying out observations, the pupils should acquire skills and habits to identify and understand the scientific and instructional aims, to plan the process of observation, perform mental and non-verbal operations and to analyse and explain the results.

There are a great variety of experiments and observations that are useful in the teaching of the natural sciences, physics and chemistry. They need not be limited to the classroom, but can be conducted in the laboratory, at a tutorial, be assigned as homework or as an extra-curricular option. The nature of an experiment or observation will vary in complexity, duration and technological sophistication according to its particular application.

Vocational training

Introducing pupils to vocational training calls for special emphasis upon methods which will help them to perform these operations by themselves. However, training the pupils to work by themselves should not be confused with downgrading the teacher's role. Vocational skills simply cannot be acquired without actually trying. However important it is to acquire practical skills, training does not end there. The polytechnical content of practical training presupposes the acquisition of knowledge of the principles on which several operations are performed, and of the inner workings of technological infrastructures. The degree of complexity of equipment in use in practical training determines the skill pupils are expected to acquire in handling equipment, planning operations, carrying them out, self-evaluation and inspection of the quality of their work.

The modern school is expected to introduce pupils to a wide variety of scientific and technological methods which are used in industry, for instance: (a) becoming familiar with technical equipment (explanation, demonstration of working diagram, of models, dismantling and assembling, using the service manual or handbook); (b) learning to handle the equipment (watching the instructor, handling technical documentation, work-place organization, making measurements, interpreting diagrams and drawings, solving particular problems); (c) doing useful work (making articles, controlling equipment, a machine, a machine-tool, maintenance and repair). Typically, towards the end of a practical course, work skills are 'polished' and efficient productivity patterns acquired. Directions and supervision by the teacher are reduced to the bare minimum and the pupils now work by themselves, especially if they are involved in actual production on a farm, at a factory or in an office.

Using systems analysis, Baty[illegible][20] gives a detailed acount of various ways in which pupils can receive oral or written instructions. Thus, before doing a vocational assignment, every pupil is given an instruction card with a list of technical specifications and the nature of the work to be performed. The instruction card presents the stages for self-evaluation, warns against common faults and defects, their causes and the ways to eliminate them. For example, the sequence of work operations may appear on the card as follows: getting acquainted with the assignment by reading the working drawing; checking the equipment, selecting tools and measuring instruments; carrying out calculations; organizing the work-place, adjusting the equipment; attaching the workpiece to the machine-tool, and carrying out the operation step by step.

Mahmutov recommends, in many instances, that the assignment cards should not adopt an imperative tone but rather should present the problems in such a way that the pupils feel an incentive to perform the operations.

The organization of pupils' unsupervised productive work is preceded by careful preparation intended not only to focus the pupils' attention on productivity but also on the inner workings of industrial production in a broader sense, and on the demands placed on the craftsman by his qualifications. This is done through a concise explanation; the speaker is well advised to come to the point at once, so that the bulk of the time may be allotted to unsupervised productive work. An approximate ratio between the length of the teacher's talk and the pupils' practical activity in a vocational training lesson is 1:3.

A number of authors maintain that a departure, however small, from the standard terminology of science and technology, from the requirements specified in the All-Union State Standards, as well as an unwarranted length of time spent on introductory explanations will tend to depreciate the vocational training standards of school-leavers. They also come out in favour of a written assignment in senior school forms on the general principles involved in the operation of equipment and productive processes going from the general to the particular. As for the junior and intermediate forms, preference has to be given to the procedure of going from the particular to the general.

Thus, the following experiment has been staged at training factory No. 1 which serves the vocational training needs of several Moscow schools. In one of the tenth form classes, the teacher used the inductive approach in making the pupils aware of particular production processes (cutting, casting, pressing, etc.) as stages in an overall process of metal-working. In a parallel class, the presentation was constructed on a deductive pattern beginning with the principles of metal-working (the techniques whereby the object is shaped by force of energy). In the latter case, the pupils proved more capable of analytical perception and displayed greater self-reliance in weighing up various metal-working techniques as compared to the inductive course.

The problem-oriented method was found to be even more effective for the introductory teacher-supervised stage and also during teacher/pupil dialogue concerning, for instance, the choice of materials, tools, instruments, tooling sequences, etc. Under this method, the teacher can begin by explaining the inner workings and method of handling a given machine-tool and how to switch it on, before posing the problem of how best to avoid the pitfalls and how to measure the work so as not to

exceed the tolerance. The main principle here is to guide the pupils to solving a production-oriented problem, and to teach them to perform some elementary assignments. In the process, the pupils are expected to try and discover the optimum techniques for manufacturing a product, which presupposes that they should be estimating for themselves the need for materials, tools, etc. The entire process – from receiving an assignment to the finished product, during which the pupils have plenty of opportunity to exercise their creative initiative – is followed by the inspection of the end-product for quality, reliability and workmanship.

An optimum approach to practical training should motivate the pupils to think in terms of technological creativity, to do socially meaningful work, and to acquire the habit of working in the spirit of socialism and collectivism. It is no less important to resort to manual training methods which are likely to make the pupil enjoy work so that he may learn to look upon it as his natural vocation, not simply as something he has to do for a living. It is absolutely essential to orient practical training methods towards the development of industriousness in children, meaning not merely love of work for personal achievement, but work for the good of all, for the benefit of the nation.

It is only through a judicial use of supervisory methods over their performance that the pupils can achieve the desired progress, whether in the school laboratory and workshop or at an industrial training factory, or on a farm.

The pupils' performance is best monitored and assessed by individual evaluation at every stage of work and, if possible, in the same order as the sequence of operations. The factors to be considered are: (a) knowledge of the assignment, correct choice of equipment, materials and tools; (b) theoretical knowledge; (c) organization of the work place; (d) correct execution and/or interpretation of the working drawing; (e) sufficient knowledge to carry out the necessary calculations; (f) competence in handling the equipment (machine-tool) for the assigned work; (g) efficient working procedures; (h) observance of safety regulations and hygiene; (i) honesty and discipline at work; (j) efficiency (quality and quantity of production).

While monitoring each pupil, the teacher is well advised to keep track of individual performance on a chart for the whole group. The results are then available to all the pupils in the group for discussion and appraisal on an individual and collective basis. Assessing performance by separate elements enables the instructor immediately to draw each pupil's attention to his shortcomings in order to rectify them, to follow the good example of his workmates or resort to their help, or give them help if they should need it. In making the assessment, it is important to distinguish between the practical and theoretical results, to determine the degree of awareness of successes and failures, shortcomings, mistakes, and ways to rectify them.

It would be a major oversight to expect the teacher to work solely on developing practical skills to the exclusion of intellectual progress. The modern industrial worker is not merely a person who does, but also a person who thinks. That is why one has to introduce a creative component into a system of practical training, i.e. the pupil should be required to design technical objects on his own, plan the technology of their production, as well as working on assigned production patterns. Knowledge of the physics and chemistry of the material in hand, and the purpose the end

product is expected to serve will enable the pupil to decide on the optimum design of the product and the way to make it. All this involves a particular capacity for reasoning. Hence there is a need for educational research to develop methods which can be used for teaching students to solve technical problems of a theoretical nature in the context of vocational training.

During vocational training assignments, the pupil may have to solve theoretical problems, even though ostensibly the purpose of the assignments is the manufacture of a particular object. By being faced with a problem which depends for its solution on a knowledge of theory, the pupil will see more clearly why the study of theory, which otherwise seems impracticable and superfluous, is necessary in school. In general, the theoretical problems of technology to be solved by pupils should be selected with regard to their individual aptitudes and abilities, and they may prove valuable in providing material for teaching games and contests, as well as out-of-class activities.

Also deserving mention are scientifically researched methods to teach optimum work habits which aim at maximum efficiency with minimum waste of energy. Such methods are typically derived from the findings of occupational physiology and hygiene, and should help the student to adopt a satisfactory work posture, to organize his work place, balance work with recreation, find the right working rhythm, maintain physical fitness, choose the most efficient working movements and create a suitable working environment (lighting, temperature, air, etc.).

The development of correct working habits in the pupil presupposes the skilful co-ordination of hand and eye (sizing up the parameters at a glance), the acquisition of measuring skills, time-keeping and precision of movement. The formation of these qualities is encouraged through special courses, by setting standards of reference and by indicating model patterns which should be followed. Other desirable work habits are acquired through the systematic practising of such operations as comparison of performance, planning, awarding points and self-evaluation to mention just a few.

The acquisition of correct psycho-motor and sensory qualities is hastened by the use (prescribed for vocational training) of such devices as training machines (film, electronic rhythm-pacer, etc.) as well as of production charts with blanks to be filled out with correct time-rating values, etc. The pupils with well-developed motor-sensory abilities are quicker to learn a job and enjoy their work. Especially useful appears to be the systematic learning of all the necessary work movements which go to make up a cycle. The movements are broken down into the elements forming a system. With the aid of special techniques the pupils' attention is focused on one or two movements of primary importance in the development of the desirable practice. Attention may be focused on the correct positioning of the working tool, the force required, the transfer of control from the visual to motor (kinesthetic) senses, etc. These techniques promote the acquisition of optimal work habits, which means the rationalization of efforts in space and time, minimization of efforts, greater accuracy of movements, all of which contribute to working efficiency.

The development of teaching methods depends on the solution of a number of educational problems which are now under professional scrutiny, for instance: determining the school-leavers' level of achievement for vocational training; frequency of exercises to develop motor functions and optimize the sequence and

consistency of movements; rating pupils' output; studying the psycho-physiological mechanism of working skills.

Methods to develop technological creativity and the capacity to experiment occupy a special place in the system of vocational training. These methods come to the fore in formal vocational training, as well as in extra-curricular activities carried out in associations and clubs for technically-minded and nature-loving children, and with the work of schoolchildren on collective and state farms. Technological creativity for children is fast becoming the goal to achieve, not unlike the goals the adults are striving to achieve in actual production. The principal methods employed in these associations and clubs are the practice of designing and modelling. The particular method adopted is based on a synthesis of the function of the object as a technical challenge. The idea is to establish a methodological approach where the termination of one stage leads on to the beginning of the next stage in order to attain the creative goal. The creative technological activities of children, as well as all the other forms of vocational training, are inspired by the productive needs of society. In other words, the pupils' creative efforts are oriented on designing and building a technological innovation, not just a plaything or something that serves no purpose, but an innovation or a technical improvement to an existing design which should serve a useful purpose in a school, nursery, private home or industrial enterprise.

Pupils who want to develop their aptitude and creativity by attending technical and similar clubs receive every encouragement. Indeed, these activities serve to strengthen the ties between personality and society, since satisfaction from creative activities is not based on egoism or individualism, but on the desire to help and serve others. Much experience has been gained in developing the technological creativity of children by Young Pioneers' cultural centres at the regional, republic and national levels. This experience is regularly featured at various display centres such as the All-Union Permanent Exhibition of Economic Achievements and Moscow's Central Exhibition Hall. This activity is also given prominence on the pages of children's periodicals such as 'Young technician', 'Young aircraft designer', 'Young naturalist', 'Quantum', etc.

One of the best examples of the creative guided-discovery approach to vocational training is the pupils' participation in farm work, which may be considered as a new initiative since agro-biological experimentation serves the needs of the local farming community. The educationist Razdymalin aptly remarked that the method of teaching using 'ready-made illustrations leaves the pupil more or less indifferent, the reproductive method bores him, but the discovery method (as applied to agriculture) fills him with enthusiasm'[21]. Usually, the initial application of the experimental-discovery method takes the form of a trial-and-error procedure, but, in the hands of a gifted instructor, the student starts making his own discoveries at a very early stage indeed. The search for higher yields requires an inquisitive person who is deeply concerned with the resources of the surrounding environment, who will spare no effort to acquire the necessary biological and agro-technical knowledge, to master experimental techniques and the skills pertaining to plant breeding. This presupposes that the pupil or group of pupils have to commit themselves to a sustained effort lasting for months or even years.

Such perseverance on the part of the pupils takes its origins in their awareness that

the experiments they stage are useful to the farmer in increasing his yields. And certainly, while working on a production problem, the pupils will gain a better idea of its scientific background. Thus, according to Razdymalin, who has spent many years as a schoolteacher in a community near Voronež, his students were able to identify a genetically superior crop variety after comparing several different samples grown in optimum conditions.

Under Razdymalin's guidance, the students engaged in an experiment carefully selected a seed-stock and sowed the seeds on a school plot for experimental purposes over several years. They gained much practical experience, developed their powers of observation and, what is especially important, learned how to apply in field conditions the genetical selection theory they had been taught in class. The highly involved experiments they performed with cross-breeds of maize, peas and other vegetables served to convince the pupils that some combinations were superior to non-cross-bred varieties. They also had a chance to see in actual field conditions the phenomenon of heterosis and the operation of Mendelian laws.

This experiment, like similar experiments in other Soviet schools, was aimed at obtaining higher yields not simply for instructional purposes but also to meet the farmer's actual requirements. This goal determines the whole experimental training programme, both formal and non-formal, as well as the experimental procedures which are divided into the following consecutive steps: (a) soil sampling and analysis; (b) seed preparation; (c) purchase and analysis of fertilizers; (d) drawing up a plan of the experiment and transfering it to the field; (e) recording observations throughout the growing season; (f) harvesting and stock-taking; (g) statistical data processing and sizing up profitability; (h) conclusions and recommendations for farmers.

If the purpose of the experiment is complex and the crop varieties used on the given farm numerous, it may be advisable to differentiate the students' assignments. It may be necessary to divide the students up into teams according to the number of varieties to be researched. There will be (as in Razdymalin's example) economists, machine-operators, agro-chemists, soil analysts and a special team of plant cultivators. All the teams are working in a united collective; by working together the pupils, besides acquiring useful skills, illustrate enthusiasm.

The discovery method thus helps mould innovators for Soviet agriculture. However, the application of this method should be discrete and, in practice, due heed should be paid to the teacher's and pupils' opinions. Even though he has to master a new approach, the teacher also stands to gain much from its application, especially in so far as his social prestige is concerned. Indeed, in this case he has an opportunity to act not only as a schoolteacher, but also as a public leader making a tangible contribution to national prosperity.

REFERENCES

1. *Metodika russkogo jazyka v srednej škole.* Moskva, Prosveščenie, 1980.
2. Šatilov, S.F. *Metodika obučenija nemeckomy jazyku v srenej škole.* Leningrad, Prosveščenie, 1977. 295 p.
3. Rez, Z.Ja., ed. *Metodika prepodavanija literatury.* Moskva, Prosveščenie, 1977. 383 p.
4. Korovkin, F.P., et al. *Metodika obučenija istorii v srednej škole.* Moskva, Prosveščenie, 1978. 2 v.

5. Šeptulin, A.P., et al. *Izučenie obščestvovedenija v srednej škole.* Moskva, Prosveščenija, 1980. 319 p.
6. Gureev, P.P.; Davydov, G.P., eds. *Metodičeskoe posobie po kursu 'Osnovy Sovetskogo gosudarstva i prava': posobie dlja učitelej.* Moskva, Prosveščenie, 1980.
7. Cvetkov, L.A., ed. *Obščaja metodika obučenija himii.* Moskva, Prosveščenie, 1981.
8. Oganesjan, V.A., et al. *Metodika prepodavanija matematiki v srednej škole: obščaja metodika. Učebnoe posobie dlja studentov.* Moskva, Prosveščenie, 1980.
9. Razumovskij, V.G., et al. *Metodika obučenija fizike v školah SSSR i GDR.* Pod red. V.G. Zubova i dr. Moskva, Prosveščenie; Berlin, Volk und Wissen, 1978. 223 p.
10. Zverev, I.D. *Problemy metodiki obučenija biologii v srednej škole.* Op. cit.
11. Lynda, A.S. *Metodika trudovogo obučenija.* Moskva, Prosveščenie, 1977. 232 p.
12. Danilov, M.A.; Skatkin, M.N., eds. *Didaktika srednej školy: nekotorye problemy sovremennoj didaktiki.* Moskva, Prosveščenie, 1975, p. 148.
13. Marx, K.; Engel's, F. *Sočenij.* Op. cit., t. 29, p. 162.
14. Erdniev, P.M. *Obučenie matematike v nacal'noj škole: opyt ukrupnenija didaktičeskih edinic.* Moskva, Prosveščenie, 1973.
15. Vsesojuznaja naučno-praktičeskaja konferencija po probleme 'Soveršenstvovanie metodov obučenija v sovremennoj sovetskoj škole', Leningrad, 1978. *Tezisy.* Red. komis.: I.D. Zverev i dr. Moskva, APN SSSR, 1977, part 4, p. 22-24.
16. Dorfman, Ja.G. *Vsemirnaja istorija fiziki.* Moskva, 1974.
17. Madelung, E. *Matematičeskij apparat fiziki: spravočnoe rukovodstvo.* Moskva, 1968.
18. Razumovskij, V.G. *Razvitie tvorčeskih sposobnostej učaščihcja v processe obučenija fizike: posobie dlja učitelej.* Moskva, Prosveščenie, 1975. 272 p.
19. Vsesojuznaja naučno-praktičeskaja konferencija ..., Op. cit., part 2, p. 34.
20. Batyšev, S.Ja. *Trudovaja pogotovka škol'nikov: voprosy teorii i metodiki.* Moskva, Pedagogika, 1981.
21. Vsesojuznaja naučno-praktičeskaja konferencija ..., Op. cit., part 2, p. 77-78.

CHAPTER TEN

Interdisciplinary teaching methods

Even though knowledge is imparted in school strictly by subjects, there is a need to identify interdisciplinary relations, both at the level of content and teaching methods. Indeed, there is an urgent need to clarify the differentiation and integration of subject areas in science (the interdisciplinary approach). The processes of differentiation and integration of subject areas, as they manifest themselves in the scientific field, are bound to be reflected in the restructuring of school subjects and the ways the pupils are to acquire knowledge. The integration and co-ordination of educational content have a direct bearing on teaching methods. In the USSR, both the school and educational research have focused attention on this problem for some time past.

The integration of other school subjects reflects the situation of the sciences. In teaching it takes the form of a fusion into one synthesized school subject (curriculum or programme) of elements drawn from other subjects, i.e. scientific concepts and methods from different disciplines are fused into an overall concept and learning process through interdisciplinary connections. In educational terms co-ordination presupposes bringing interrelated subjects into a common curricula in the manner of interpreting concepts, phenomena and processes, with due regard to the scope and the time allotted. This integration is exemplified as follows. At the primary level, where the pupils are just beginning to get acquainted with the world they live in, knowledge is not yet differentiated (primary synthesis), while its integration covers vast ground without, however, probing deeply into concepts, ideas and laws. The elementary course of natural history taught to juniors is programmed precisely along these lines. Many other countries have similar junior courses. However, unlike certain other countries where this integration of natural studies persists in the secondary school, from the fifth to the tenth form Soviet children take natural and exact sciences separately. Teaching by separate subjects in this case serves to avoid a fragmented approach, since true integration cannot be achieved by fusing incompatible pieces of knowledge into a single, bulky, quasi-integrated subject. In the senior forms of the Soviet school, knowledge integration takes the form of interdisciplinary courses such as social science or general biology, the interdisciplinary approach also manifesting itself in the content of each individual subject. Thus, the Soviet school follows the pattern of integration at the elementary level, while at the secondary level it follows the line of subject-differentiation and interdisciplinarity. This pattern determines the selection and application of teaching methods to reject exaggerated reliance on the 'complex' method which, back in the 1930s, came close to liquidating individual subject teaching in Soviet schools.

Without going deeply into the problem of interdisciplinary relationships as such [1,2], discussion will be restricted to the area of immediate concern to teaching methods. Interdisciplinary connections and teaching methods influence each other and possess a kind of internal unity. Interdisciplinary connections in the initial stages of formal education provide a motivating stimulus. Later on they acquire importance in broadening the pupils' point of view; they also stimulate cognitive activity. Whilst examining an object from different angles, the pupil makes use of various learning techniques, which in turn depends on the activation of his reasoning by induction, intuition, deduction, hypothesization, etc. Establishing interdisciplinary connections depends on problem orientation. Searching for techniques to solve problems is a creative process and requires the application of knowledge in novel situations. In so doing, the pupils are likely to see the advantages of a particular technique, and to consolidate and become familiar with acquired abilities. The interdisciplinary approach serves to stimulate the application of heuristic teaching methods. Comprehension and imagery enable a particular knowledge component to be introduced or excluded at the appropriate moment and make the whole process more dynamic and flexible in operation.

Thus, the introduction of interdisciplinary connections acts to change the entire teaching/learning process. In consequence special emphasis has to be given to integrating the teaching techniques, forms and visual aids that are typically used in teaching the subjects which are to be taught together.

As an example, a brief account follows of a physics lesson in a Leningrad school (Maksimova, 1981). The topic 'Phenomena corroborating the complexity of atomic structure. Rutherford's experiments' was presented in an expanded manner, the students being given a chance to display their knowledge of chemistry, mathematics, social science and foreign languages in the same lesson. In order to put the students' knowledge of the atom into perspective, the teacher made a comparison of metaphysics with dialectics in terms of philosophy. Reference was made to the fact that Mendeleev was the first to doubt the indivisibility of the atom. Recalling Becquerel's discovery (which they knew from the technical translations from French they had been assigned to do), the pupils were able to account for the complexity of the atom by referring to the phenomenon of natural radiation. Getting the pupils to resort to the logical analysis which was known to them from the course of mathematics, the teacher asked the pupils to disprove Thompson's atomic model by calculating the positive atomic charge.

This experience shows that the interdisciplinary approach above all serves to activate the application of logical teaching methods and makes for greater self-reliance among the pupils in solving intellectual problems.

This point can be further illustrated by a chemistry lesson in another Leningrad school. While explaining the chemical properties of glucose, the teacher made references to physical phenomena and philosophical laws (the law of quantity-to-quality transition). To explain the formation of glucose it was necessary to turn to the phenomenon of photosynthesis from the biology course. Referring to the prominent Russian chemist Butlerov, who was the first to synthesize glucose in 1861, the teacher again drew attention to the philosophical significance of that discovery which served to refute the idealistic 'vital force' concept.

These examples are just further proof of the important role played by a master plan

in logically interconnecting several sciences. However, to make it work one has to train the pupils to perceive interdisciplinary relationships and acquire methods to establish them. Of special interest to the present discourse are the recently introduced assignments whereby the pupils are expected to study several subjects at a time. Maksimova's experiment is just a case in point. She asked students the following questions, the answers to which depended on a knowledge of biology, chemistry and physics: 1. What knowledge of physics and chemistry is required to understand the mechanisms of respiration and digestion? 2. How does the knowledge of physics and biology help to understand the Mendeleev Periodical Law in the chemistry course? 3. What physical, chemical and biological knowledge is needed to hold a seminar on 'Energy conservation and transformation laws in organic and inorganic substances'? In subsequent discussion of the answers to these questions, the pupils had an opportunity to define and explain the connections between different subjects.

In the context of an interdisciplinary approach, one can use both generally applicable teaching methods and techniques, as well as innovative methods and techniques specific to a particular subject. General procedures include the teacher's introduction, teacher/pupil dialogue, demonstration, problem orientation, recitation, experimentation, observation, etc. Innovative and specific techniques essentially involve the use of textbooks on several subjects in the same lesson, visual aids featuring material drawn from more than one subject, written tests of an inter-subject character (biology and literature, chemistry and biology, physics and ecology tests), interdisciplinary quizzes, etc.

Another effective technique is an assignment of an interdisciplinary character whereby the pupils are required, for instance, to search for the instances of application of physical laws to natural phenomena in popular science magazines. With reference to the interdisciplinary approach, as in other instances, use may be recommended of problem-oriented teaching methods involving experimentation and guided-discovery work in the laboratory. It seems obvious enough that the application of problem-oriented techniques is, in a sense, dependent on previously acquired knowledge, sometimes in a summarized form, which the teacher imparts to the pupils, as it were, second-hand.

Teaching techniques in an interdisciplinary context should be as flexible as possible, depending on the material which may be drawn from related subjects. Thus, the conclusive history lesson on the mutiny of December 1825 in Russia may involve the teacher's introduction on the influence exerted by Russian writers and poets, such as Puškin and Griboedov, on the Decembrists' minds and also on the influence which the Decembrists themselves exerted by the mutiny on the progress of Russian social thinking and literature. In the process, the pupils are invited to quote appropriate literary passages.

This point is further corroborated by the following example. Learning the gerund in an English lesson is preceded by learning similar grammatical forms in Russian and the analogy is then further emphasized by appropriate oral and written drills.

In mathematics lessons, the teacher turns to the history of discoveries in physics and geography. The pupils may be given a chance to display their calculating and measuring skills by surveying the school garden or grounds during a lesson.

In explaining the phenomena of photosynthesis and the reaction of chloroplasts to certain wavelengths of the light spectrum, the biology teacher may perform the demonstration on a spectroscope, while the actual functioning of the spectroscope is clarified by the pupils themselves by drawing on their knowledge of physics.

The knowledge of how to read working drawings is applied in vocational training lessons. In explaining the operation of a tractor, reference is made to the internal combustion engine already familiar from the physics course.

All these examples reveal that, depending on the nature of the material to be borrowed from related subjects, the lesson may be given in the form of a narrative, a dialogue, unsupervised work, an experiment, or some kind of practical activity.

The interdisciplinary connections, established according to the identity of corresponding scientific methods, may take the form of observation, experimentation, modelling, the transfer of a method from one science to another (solving mathematical problems during physics or chemistry classes, plotting geometrical graphs to illustrate mathematical functions, etc.).

To link subjects in the humanities, a fusion is practised between logical methods and those to portray the life of man and society. In relation to the humanities, wide use is made of lectures, seminars and dialogues with the aid of audio-visual techniques.

The development of teaching methods based on interdisciplinary connections has served to change the content and organization of lessons. Sometimes one lesson is conducted by two teachers from related subjects. Much experience in team teaching has been gained by the Laboratory of Environmental Education (headed by the author of the present text, of the Research Institute of Educational Contents and Methods of Teaching of the USSR Academy of Pedagogical Sciences. Thus, the issues of the nature/society relationship, the impact of progress in science and technology on biospheric processes, and the optimization of nature conservation methods have furnished talking points for lessons of social science and biology to be conducted simultaneously by both teachers. At such lessons, a synthesis is made of biological and social aspects of the above issues. Much has already been published on the experience of fusing lessons (mainly extra-curricular) of physics and biology (featuring the application of such physical devices to study physiology as generation of biocurrents, and isotopes to diagnose and treat diseases). Lessons can be directed towards the links between such natural and exact sciences as physics, biology, physical geography and elementary natural history with arts subjects. Thus, during such lessons, scientists are asked to give their opinions on art and artists on science; a lesson may include a debate on general trends in science or art (the influence of advances in mechanics, optics and acoustics on architecture, painting and music), a demonstration of physical phenomena by examples from art (the phenomenon of air column resonance in the laboratory was once illustrated by the same phenomenon in one of the auditoria in the city of Riga; the phenomenon of colour displacement was related on another occasion to impressionist painting, etc.).

It appears very useful, as far as teaching methods go, to combine the artistic portrayal of a natural object with its purely diagramatic presentation to emphasize its essence. This trains the pupil to identify two cognitive techniques in his mind: scientific and artistic. Much experience has been gained by teachers resorting to such typical use of the interdisciplinary approach as the illustration of historical

facts and events by appropriate passages from literature, both classical and modern. By relating the teaching of biology to painting, poetry and music, biology is made much more interesting and less rigid.

Another example is illustrated by out-of-class projects involving interdisciplinary assignments; they may be appropriately designated as 'Forest', 'Tree', 'Water', etc. The schoolchildren are called upon to make considerable use of their knowledge of physics, chemistry, biology and geography. The visual presentation aspect of these projects may require drawing, painting and creative writing.

Pančešnikova[3], while referring to the value of method in imparting specific learning techniques to the pupils, emphasizes (in terms of the relationship of economic geography to history) the need to:

1. Establish historical cause-and-effect connections while examining the modern economic geography of the country or given locality.
2. Draw a historical analogy to explain modern developments in economic geography.
3. Identify universal historical concepts and to include them into the concepts of economic geography.

Imparting these techniques depends on raising the pupils' cultural standards enough to enable them to explain, for instance, the negative influences of feudal customs in India, or demonstrate the effects exerted by industrial relations on productive forces in any given country. Thus, the questions 'What to connect?' and 'With what?' have a direct bearing on the question 'How to connect?', i.e. on a method to establish interdisciplinary connections.

It is extremely important to train pupils to apply the concept of interdisciplinarity in order to perceive the close relationship between concepts governing ideology and concrete scientific knowledge. Thus, at a social science lesson in the tenth form, after debating a quotation from Engel's saying: 'Marx's teachings are omnipotent because they are true', the pupils explained the meaning as follows:

Marxism derives from the prior developments in philosophy, science and practice and it is this that distinguishes it in principle from metaphysics and idealistic doctrines; the world is intelligible and materially united; the law of balance between opposites and confrontation between opposites operates in nature and society; the law of transition from quantitative changes to qualitative changes is valid; the negation-of-negation law is valid; the role of practice in cognition is crucial; Marxism is an ideological instrument to transform the world.

The pupils corroborated the above philosophical concepts by seeking concrete knowledge on:

- social revolutions and transitions from one social structure to another; precursors of Marxism (from history and social science);
- the law of the conservation of energy, spectral analysis, atomic structure, the discoveries of Copernicus, Galileo, Giordano Bruno (from physics and astronomy);
- Mendeleev Periodic Law, homologous series of hydrocarbons, polymers (from chemistry);
- cell structure and evolution theories; assimilation-dissimilation; heredity and mutation; origin of life on the Earth (from biology).

Thus the portrayal of an integrated view of the world is brought about through the content and methods of interdisciplinary relations in school instruction. The place of methods for forming a world outlook in the structure of interdisciplinary relations has been singled out by Baturina in the following diagram (presented here with some modifications)[4]:

The humanization of teaching about the natural sciences, which is a reflection of the unity of nature and society, is bringing teaching methods of various disciplines into closer proximity. The fusion of natural and social sciences is typified by modern environmental studies. Since it is profoundly interdisciplinary, it is bound to influence formal education. The study of environmental problems has become an independent trend in educational science and in formal education, and has been designated as environmental studies[5].

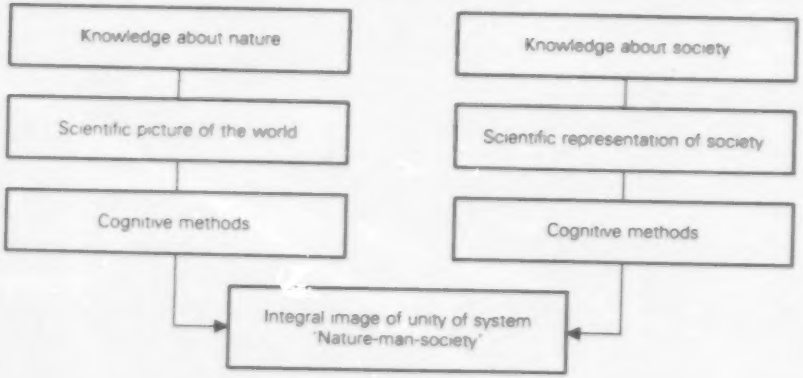
A clear indication of the success of the integrated approach in the final stages of formal education is the breadth and depth of judgements made by upper secondary students about the world as a whole. As evidence of this, we quote the following text written by a Moscow schoolboy. He presents his outlook which results from a sound grasp of interdisciplinary content and methods[6]:

Let us imagine with our mind's eye all the objects and phenomena of nature. There are tiny specks and giant planetary systems, unicellular organisms and highly-complex living creatures. Nature presents a wide variety of forms and attributes, but all natural bodies have the same property, and that is a property to exist. whatever we may think of them or whether we think of them at all. Matter, in whatever form or shape, makes itself known through our sensations.

According to scientific data, even celestial bodies, which have existed for thousands of millions of years, have a beginning and an end; they appear and disappear. Yet, matter is eternal in time. Objects may decline and disintegrate but they do not disappear completely. The nuclear decay of one chemical element gives rise to other elements. The decomposition of one substance means the appearance of others. One generation of living beings is followed by another and death itself does not result in a total elimination of the atoms and molecules comprising the organism. Physics, with its laws of conservation, confirms that matter, even after the most drastic of transformations, is never lost nor destroyed.

Matter is not only endless in time, but also boundless in space. Natural and scientific

FIGURE 3. Interdisciplinary relations for a world out look.



discoveries constantly broaden the boundaries of the known world. And there is no end to the universe, nor any known limit.

Within bodies there are incessant changes going on: a constant movement of atoms, molecules and elementary particles. Even more complex is the movement in organic life and in society. The organisms of human and other living creatures are the scene of complex physiological processes. In natural history, species is superseded by species. In human history, there occurs a gradual development and renovation of all facets of social life. The material world opens before our eyes as a majestic image of universal motion and change, with no room for anything stable, unalterable or everlasting. Modern science has irrefutably demonstrated that it is only in motion that matter exists. Motion, understood as change, as an eternal process of renewal, is an inherent, fundamental property of matter, the very definition of its existence.

All bodies can be divided into two groups of an organic or inorganic nature. The bodies of the organic world (animals and plants) possess the following properties: growth, development, procreation, reaction; all the organic substances consist of proteins, fats and carbohydrates. These properties are common to all that lives. The organic world (living nature) is characterized by several levels of organization from uni-cellular forms to the biosphere. The living world comprises a wide variety of species. Yet, only a small section of highly organized living creatures are in possession of reason. Reason may be defined as the ability of beings to analyse the surrounding world and to think along the lines of logic.

Granted, far from every tenth-former is able to come up with such an exhaustive discourse. Yet, experience shows that it is possible to synthesize knowledge of the natural sciences on the basis of interdisciplinary relationships into an integrated world image based on scientific evidence.

Thus, co-ordinated teaching of various school subjects is required to develop intellect, speech faculty, cognitive activity, self-reliance and industriousness in the pupil. These will be brought together in the personality of every pupil and through the harmonious influence of individual subject teachers. It is obvious what will happen if one teacher takes care of speech development while the other does not, if for one subject the pupils are regularly given independent assignments while for another they are seldom or never given such an opportunity. In the latter case, the victim will be the pupils' intellectual and emotional development.

In the absence of unity of purpose and co-ordination between specialist teachers, one can never be expected to solve the problem of effectively harmonizing teaching with personality development. To attain the desirable measure of harmony and interaction, all the teachers have to arrive at the same opinion of how to attain it and each of them has to become adept at using the teaching techniques specific to his area of knowledge.

REFERENCES

1. Zverev, I.D. *Vzaimnaja svjaz' učebnyh predmetov.* Moskva, Znanie, 1977. 64 p.
2. Zverev, I.D.; Maksimova, V.N. *Mežpredmetnye svjazi v sovremenoj škole.* Moskva, Pedagogika, 1981.
3. Pančešnikova, L.M. *Osnovy metodiki obučenija ekonomičeskoj geografii zarubežnyh stran.* Moskva, Pedagogika, 1975. 200 p.
4. Zverev, I.D., ed. *Mežpredmetnye svjazi v processe prepodavanija osnov nauk v srednej škole: materialy Vsesojuznoj konferencii.* Moskva, NII obščej pedagogiki, APN SSSR, 1975, p. 31.
5. Zverev, I.D. *Ekologija v škol'nom obučenii.* Moskva, Znanie, 1980. 96 p.
6. Zverev, I.D. *Vzaimnaja svjaz' učebnyh predmetov.* Moskva, Znanie, 1977, p. 50-52.

CHAPTER ELEVEN

Selection and combination of teaching methods

The selection and combination of teaching methods bear a direct relation to the content of teaching. Certain educationists tend to identify objective and subjective criteria of method selection. Objective criteria include the goals of teaching, educational principles, the content and organizational forms of the educative process; while the subjective criteria are the availability of books, manuals and aids, the teacher's qualifications, the school hours, health facilities, the school's physical resources, etc. Each of these factors can be expanded still further. Yet, what really matters is their hierarchy and the degree to which teaching methods are determined by the factors listed. Granted, as we have already said earlier, these methods should above all be subordinate to the goals, such as the acquisition of knowledge, the development of cognitive activity, creative self-reliance, communist outlook, and the behaviour patterns conforming to socialist moral principles. At the same time, the final choice of a method will be dictated by the content, which should typically reflect both social objectives and specific teaching tasks of education and upbringing.

The multiplicity of knowledge imparted in a single lesson presupposes the use of a whole variety of teaching methods – methods which are combined on a complementary basis. Essentially, the selection of methods will be determined by the configuration of concepts to be presented to the pupils in each particular lesson. In presenting the content of any particular concept in the lesson, an arbitrary selection and combination of methods is manifestly unacceptable. Yet, this is precisely the approach that was recommended in a recent teacher's manual which specified - in presenting the topic 'Sowing' in the botany course in the fifth form – the indiscriminate use of any of the following teaching methods: informative, problem-oriented, partly exploratory and discovery. This recommendation overlooks the content.

In selecting methods one is largely guided by the pupils' intellectual background, their psychological maturity and developmental characteristics, the link of continuity between the material to be imparted and the already accumulated experience of life and study, and the pupils' presumed capacity to absorb the given amount of material. According to Krupskaja familiarity with an object is a vital link in the methodology chain, of which method selection is part. In the global sense, there is little or no ambiguity between the selection of teaching methods for the junior, intermediate and senior school forms. After taking the pupils' age into consideration, use is made of a wide variety of teaching methods which are either recommended by the existing method manuals or selected by teachers on the basis

of practical experience. Yet, from the educationist's point of view, the selection of methods for the various stages of formal education still awaits further corroboration. In terms of educational theory, the problem has so far been approached largely empirically.

Since method selection depends on the pupils' intellectual calibre, and vice-versa, the principal emphasis is upon the awakening and further development of the pupils' creativity.

Recognizing the teacher's leading role in the organization of teaching and the application of teaching methods, the Soviet educationists and methodologists are aware of the part played by the teacher's personal and professional background in method selection. An experienced teacher would make a conscientious choice of methods and, with due regard to his own strong and weak points, would transform and modify them. In educational research and classroom work alike, one cannot avoid these subjective factors, which are in no case engendered by the teacher's arbitrary desires or aversions; on the contrary, the teacher, in modifying or reselecting a method, is typically guided by pragmatic and presumably justifiable considerations. His decision in favour of or against a method may, for instance, depend upon his personal ability to narrate literary works, to stage complicated experiments (requiring, by the way, designing ability) and to use audio-visual aids to the best advantage.

Other limitations on the application of methods depend upon the school hours and the organization of the educational process. The efficient use of time in teaching has long been regarded as the most essential rule in classical pedagogy. The influence of time on a method is especially important in avoiding overworking the pupil. This problem is now being thoroughly looked into by a multi-disciplinary panel of educators, psychologists and health workers who have been assigned the task of rating the learning effort of pupils with due attention to the difficulty and complexity of curricular material, study time and the pupils' health. In choosing a method, heed should be paid to its utility for the pupil.

The choice of a method is largely determined by the material resources, equipment and teaching aids available. The updating of teaching methods likewise depends on the use of modern teaching technology and hardware. The methodological advantages of up-to-date teaching technology (simplicity of operation, the vivid presentation of content, the clarity of problem-solving) are a weighty argument in favour of their discrete application in conjunction with appropriate teaching methods.

Teaching staff should be familiar with the conditions and criteria for selecting methods. With this purpose in view, emphasis is placed upon refreshing the teachers' expertise in methodology and the theory of methodology (to increase self-reliance). The teachers are expected to update their knowledge particularly by combining various methods to attain optimum results, to commit to memory some of the more complicated methods and to apply method selection criteria in actual classroom settings[1]. Thus, at a regular meeting of teachers to discuss methodology at a given school, those present can be asked to determine which methods are the most expedient to evaluate knowledge about previously acquired material (recitation in front of or within the class, a brief written test, tape-recorded dictation exercise). At another meeting the teachers may be invited to pinpoint the optimum use for non-verbal discovery methods in an unsupervised situation. To verify the

correctness of initial perception and subsequent consolidation of knowledge, the teachers are expected to select methods for the pupils' self-evaluation.

An efficient technique to improve a teacher's capacity to select methods is through the comparison of method selection recommendations in manuals with those the teacher (or a colleague) has developed himself from experience. As a result, the teachers improve their professional capacity to select methods by following the entire inventory of principles of teaching, by paying due heed to the entire set of given conditions without going back on criteria. The teachers may improve their educational versatility and flexibility by drawing upon the most successful cases of method selection in the past. They also find it practicable to learn to substantiate the choice of specific groups of methods for a definite teaching purpose and identify within the groups the basic methods designed to make the pupils perceive the main concepts.

To help teachers overcome difficulties on a choice of methods, instructions should be given on selection procedures which would expand teachers' perspective about the number and quality of available methods and enable them to make a realistic assessment of their own capacity to make the most efficient use of that multiplicity. As we have already said earlier in this discourse, sometimes a superficial description of the complexity of a method prevents the teacher from appreciating it to the full. Sometimes, it is the lack of adequate reference material that makes it difficult for a teacher to select the optimum methods in a given educational setting. In short, the material in method selection manuals for particular subjects and educational manuals in general is too sparse to help the teacher attain an adequate degree of method selection and combination. This is especially tiresome if the teachers' own experience is inadequate for the purpose. Commonly, teachers are too used to their own habitual methods to want to get out of the rut. It is important to persuade such teachers to reconcile themselves to the idea of being professionally self-critical.

Among novice teachers with little experience there is much flexibility and enthusiasm for the latest recommendations of method manuals; however, in applying these recommendations they regretfully follow a trial-and-error pattern. Until now, the best results, as far as a sound choice of methods and their judicial use are concerned, have typically been achieved by proficient teachers who have by now updated their own experience and brought it in accord with the latest in curricular philosophy. They are therefore in a position to apply methods of their choice in each particular setting, having beforehand established if the methods are really suitable for the teaching goals in hand.

It is especially difficult to make a selection of problem-oriented teaching methods. Indeed, it is incumbent upon the prospective user to determine in advance how long it will take the pupil to solve the given problem, to complete on his own a theoretical or experimental study he is expected to perform, or to come up with a practical solution he has been assigned to find. In advance, the teacher sizes up the sequence of the pupil's reasoning and outlines a problem-oriented approach as a method to study the lesson's content.

Summarized below is a physics lesson on 'Electric current in electrolytes'[2]. Having identified three key factors in the lesson, the teacher indicates which of them can be solved as problems and which can be introduced in the form of 'ready-made' pieces of information.

1. The key problem (electric current in electrolytes is carried by positive and negative ions) can be introduced on the basis of previously acquired knowledge on electric current, ions, conductivity, electric field, electric circuitry and electrons. Having assimilated all that knowledge, the pupils transfer it into a new situation and, by answering a set of stimulating questions, finally come to answer the problem question. In the course of teacher/-pupil dialogue, the teacher introduces the definitions of such new concepts as 'electrolyte', 'cathode' and 'anode' in ready-made form.
2. The concept of dissociation of salt molecules into ions in water solution is too complex for the problem-oriented method, yet at this particular level it cannot be considered basic and may well be put off for later study. For the present (seventh school form), this concept is not yet susceptible of unsupervised in-depth scrutiny since the pupils lack the necessary background knowledge. Therefore it is presented in a description.
3. The concept of charged particles resulting from dissociation is susceptible of cognition by the pupils who have knowledge of the molecular structure of which the positively and negatively charged particles are part. Their respective charges are established by actually testing and processing the data obtained in the laboratory. Thus, this portion of the lesson is realized in the form of problem-oriented search and depends for realization on the availability of appropriate laboratory equipment.

In selecting problem-oriented teaching methods, it is clear from the above how important it is to pay due attention to the extent to which the pupils have acquired the necessary background knowledge, since it is this factor which will finally determine the combination of problem-oriented and expository teaching methods in the matrix of a lesson. Babanskij has established the crucial significance to the application of problem-oriented and discovery methods of the ratio between newly introduced and background concepts and abilities. If the ratio is obviously in favour of the latter, the use of an expository technique is inadvisable. Neither is it advisable to decide in favour of problem orientation if the background material consists of just so many incoherent facts. Nor is excessively involved material, overcharged with recondite scientific data, considered suitable for a problem-oriented type of lesson. The material of each curricular section summarized at the end of the section in an ideological spirit is also imparted in class in a problem-oriented manner.

Combining several methods within the framework of one lesson should be done carefully. Indeed, the concept of a variety means that the chosen methods should complement one another. As an eminent Soviet reformer of juvenile delinquents, Anton Makarenko once put it: 'Whatever the method in hand, it cannot be effective if used, as it were, in "blissful isolation".' Besides, the principle of polyvalence and the correct combination of teaching methods should provide a safeguard against the absolutism of a method or a group of methods to the exclusion of all others. The logical base for combining a selection of teaching methods should be brought into line with the principal concepts of the imparted material, since in order to reveal the fundamentals or the particular characteristics, one has to resort now to one method and now to another.

Teaching methods develop with developing concepts, with progressive knowledge and the pupils' reasoning power. The motive force behind the pupils' intellectual development is exemplified in the collision between already acquired knowledge (and learning habits) and that which the pupils are yet to acquire.

REFERENCES

1. Aleksjuk, A.N.; Babanskij, Ju.K.; Har'kovskaja, V.F. *Vybor metodov obučenija v srednej škole.* Pod. red. Ju.K. Babanskogo. Moskva, Pedagogika, 1981. 176 p.
2. Ibid., p. 91-92.

CHAPTER TWELVE

Teachers' contribution to methodology

The relationship between the theory of teaching methods and their practical application manifests itself not only in the influence of the former over the latter, but also in feedback derived from practical teaching situations. Ostensibly, teaching methods have indeed derived from situations of putting theory into practice, yet, at times, theoretical conjectures, teachers insist, are anything but relevant to classroom work; at the same time, theorists are likely to take a suspicious view of even the most creative contributions to theory when they originate in the classroom[1].

In examining how methods are applied in the classroom, the author of the present text has relied upon statements by individual teachers regarding modern curricular philosophy and as reflected in teaching manuals for particular subjects, as well as on a summary of the general characteristics of experience of using methods in the classroom[2].

A questionnaire was sent to teachers to find out what they thought about the theory of teaching methods and how deep their knowledge of it was. A total of 322 replies was received. Most of them came from subject teachers and only a few from class teachers. The results indicated that 64 per cent of the teachers had attended in-service refresher courses (on methodology) in the five years prior to the survey. The teachers' average length of service was 17.5 years. Those with over ten years' experience of teaching contributed the most useful replies. Attendance at refresher courses and teachers' collaboration with methodologists, it was considered, had brought about positive results.

Among other things, the questionnaire was concerned with how much the teachers had gained from theoretical sources as against practical manuals on teaching methods. As a rule, practically all replies made reference to the latest developments in teaching methods. Books on the theory of methods are popular with teachers.

Next there was a question about a preferred definition of teaching method. Over 60 per cent would define teaching method as a mode of teacher/pupil activity for the pupils to acquire knowledge, skills, outlook and to attain self-fulfilment (incidentally, a similar definition is found in the Encyclopaedia of Pedagogics, a standard reference on the subject). Some of the contributions defined teaching method as a teacher-applied logical procedure to get the pupils to acquire knowledge and skills (12 per cent of replies) and still others as a medium to impart knowledge or a technique to organize the pupils' cognitive activity.

Far from exhaustive in the replies is an inventory of factors to determine method selection. About 75 per cent of the replies would limit such factors to particular aims

at a particular stage of teaching, and even to a particular lesson. Only a few replies stated that in selecting teaching methods one should be guided, besides particulars, by such universal considerations as the content of material to be imparted, the pupils' cognitive initiative, the connection of teaching with everyday life, the pupils' proficiency, the pupils' awareness of the need for factual knowledge acquisition, etc.

There is no clear distinction in the replies between non-specific teaching methods and those to teach particular subjects. Most teachers tended to perceive the distinction only at the level of actual teaching techniques. According to 10 per cent of replies, all teaching methods are non-specific; 12 per cent of teachers in the survey included oral discourse, explanation, observation, demonstration, tutorials and laboratory lessons into the non-specific category of teaching methods. Some of the teachers (about 10 per cent) tended to confuse non-specific methods with such essentials to the teaching process as liveliness, explicitness, comprehension and cognitive initiative. A considerable section of the teachers (43 per cent) tended to confuse methods and techniques.

A technique is defined as a component of method. Such techniques are exemplified by the following: drawing up the plan of a lesson; recitation during a lesson, repetition; introduction to a laboratory experiment; demonstration; use of technical teaching aids; problem orientation; techniques to introduce the elements of novelty and analogy.

The classification of methods proved puzzling to most of the teachers in the sample as a result of, according to teachers themselves, its inadequate explanation of educational theory. The teachers limited their replies to the identification of classification criteria. They included among such criteria the character of pupils' cognitive activity and the degree of their cognitive self-reliance.

The next question concerned the teachers' opinion as to the priority areas in the improvement of methods. The answers provided touched upon a number of vital issues of formal education. The prevailing opinion was that methods could be best improved by making more extensive use of problem-oriented teaching and stimulating the pupils' cognitive potential (some 50 per cent), while 30 per cent of the replies favoured a wider application of technical teaching aids. In answering the question, many emphasized an individual approach to pupils, greater reliance upon the findings of educational research and scientific data concerned with teaching, more systematically organized textbooks, and improved opportunities for teachers' self-education.

Thus, the teachers in the sample showed that they were still insufficiently versed in certain aspects of methods theory. As is clear from the replies received, the findings of Soviet theorists have not yet been thoroughly appreciated by most schoolteachers, who do not yet take full advantage of them in their day-to-day work.

Nevertheless, most schoolteachers do know what the principal criterion is for choosing the right method, and for applying and improving it, and that is the degree to which a method serves to *develop in the pupil cognitive initiative and self-reliance.* The real test of a method, most teachers believe, is a clear and conscious grasp by the pupil of knowledge, learning techniques, and an adequate development in him of the capacity to apply the acquired knowledge. A method may be pronounced

adequate only as long as it is good enough to awaken in the pupil *learning initiative*, a sense of responsibility for learning or a failure to learn.

Innovative teachers have often proved capable of devising their own teaching methods and techniques to meet the requirements of the newly-updated content of education.

The successful application of a teaching method in the classroom will essentially depend on such qualities in the teacher as discretion, acquired through experience, and professional qualifications, as well as a knowledge of and interest in the theory of education in general and that of teaching methods in particular.

Practically every Soviet school keeps its own register of teaching methodology, to which innovative teachers are invited to submit contributions. Their contributions are most valuable to the theory of education. Indeed, a theorist entrusted with compiling reference books for schoolteachers should never consider himself infallible, but, on the contrary, he should draw upon classroom experience to illustrate by particular examples the motivation behind his examples, thus demonstrating his flexibility and positive attitude to criticisms.

On the other hand, a teacher with a successful record of classroom performance cannot be solely congratulated for an adequate selection of methods. Optimum method selection and application will depend on a variety of factors operating in the classroom setting: the teacher's ability to apply ideology and educational theory correctly to the content of the subject he teaches; his understanding of the aims of education; his civic responsibilities; his professionalism guided by the communist principle to work 'according to one's abilities'.

A successful teacher is expected to be particularly good at one particular teaching activity, such as experimentation in the laboratory, organizing hikes and excursions, or even devising an original system of presenting material, such as a differentiated approach to every pupil.

A method cannot be pronounced good or bad without first examining the qualities of its user. Therefore, a really competent teacher would never think of using one method to the exclusion of all others, still less believe in it as a panacea. Indeed, a teacher may owe his success to personal qualities, professional qualifications, drive and, for that matter, he may wield that teaching gift which is hard to explain in terms of theory and methodology. However, there are examples to the contrary of teachers pedantically sticking to a method with few or no positive results.

This negates neither theory nor its practical application. Yet, a valid theory should motivate the teacher to search for new creative solutions instead of paralysing his professional initiative. There are many graphic examples of top-performing teachers who owe their success to a combination of an excellent method, a discretely ordered approach to the material in hand and a readiness to rely as much as possible on the pupils' cognitive initiative. Here are a few illustrations.

Worthy of note is the experience of Moscow elementary classroom teacher S.N. Lysenkova who has had very favourable press coverage. Having spoken at several conferences, she had occasion to address a plenary session of the USSR Academy of Pedagogical Sciences and has recently published a book[3]. A considerate and devoted teacher, she spares no effort in the search for the most effective ways to teach, to awaken interest in and love for learning in every pupil, as well as a sense of self-reliance. Based on her own experience, she has devised an original set of

teaching techniques which have borne fruit, her pupils having a good reputation for high achievement, mastery of learning skills and independent thinking; they have a very good chance of growing up to be as socially responsible and humane as their teacher.

Lysenkova has put together an optimum combination of classroom techniques and personal practices which make it possible to give an equal opportunity to everyone in the class. Also worthy of note is the fact that her teaching techniques (as far as elementary schooling goes) conform strictly to the general principles underlying teaching. What, then, is new about her mode of teaching? Well, the innovation consists in introducing a set of carefully standardized teaching symbols, diagrams, tables, cards, etc., which, to use the author's expression, play the role of 'key terms' in organizing and guiding the pupils' powers of reasoning. The originality of this teaching mode does not end there. Key terms are useful in teaching because they combine in themselves many aspects of teaching method, being based on: a logical search for truth and knowledge; sources; psychology; and conforming to a plan. Even though this method is not unknown to educationists, the teacher has done well to rediscover it. Her accomplishment is not so much in using a combination of visual aids, as in getting this combination to conform to universally accepted laws of psychology and educational science. Indeed, any teacher would resort to an increasingly difficult scale of symbols, as long as these are helpful in acquiring the abilities to bring about the transition from visual-sensory to abstract-logical perception, a transition children usually find so hard to effect.

The author seeks to use several different visual aids at a time in order to individualize teaching by distributing different aids among different pupils, which obviously makes for the pupils' greater self-reliance in solving cognitive problems.

'A carefully arranged system of visual aids', S.N. Lysenkova maintains, 'serves to awaken the pupils to what is going on in class, to what the teacher is asking and their classmates are answering; it also serves to break the classroom monotony and make recitation more vivid and confident. In short, the children are now more interested in learning. They are motivated to think faster, write down and freely discuss things, and their discussion assumes a more lively air in general. Every stage of the lesson is marked by activity and participation'[4].

The author's assessment of her own innovative performance is undoubtedly realistic, being additionally borne out in her many and equally realistic accounts of lessons and parts of lessons.

The author makes extensive use of concepts like 'guidance through key terms' and 'running-commentary guidance'. The techniques designated by the above terms interact. The former term stands for teacher-generated auxiliary techniques, the latter for the pupils' guided response and for the degree to which the pupils understand and acquire knowledge with the aid of visual devices. The stress in this case is upon the development of reasoning power, the justification of arguments and creative self-reliance. To this end, the teacher seeks to construct situations to provoke an argument, a clash of opinions, a collective search for the right conclusion.

Now and then a pupil is assigned the role of teacher. It is, however, incumbent upon the teacher to see to it that theory and applied knowledge are correctly

balanced, and that concepts and rules are acquired through practising rather than memorizing. In the process the terminology of the subject in hand is made as explicit as possible, substance and meaning are added to the drills. Theory is acquired in an order of ascending complexity, being co-ordinated with a system of exercises for the development of skills and habits intended to teach the children to think faster.

Throughout this innovative procedure, the teacher retains a sense of proportion. She has come up with a system of practices tailored to her particular teaching needs and has managed to increase the time allotted to discussion in class by cutting down on copying exercises. More economy of time is made possible by the use of an ingenious selection of visual aids, assignment cards and summary tables.

Lysenkova's new approach presupposes the presentation of a skilfully composed blend of acquired and new material. It also implies the introduction in the current lesson of elements of material to be presented in forthcoming lessons as a preview of new and challenging problems. Classroom work is divided into three stages: introducing portions of material as a preview of future study; clarifying newly-introduced concepts for study in the present lesson and making suggestions for their application; unfolding to the pupils new perspectives and having them develop fluency in using newly-acquired abilities and learning habits. Every stage of the process is marked by the relationship between what has been studied and what is to be studied, by concentrating on difficulties, and by a lively tempo of work. Thus, acquired knowledge constitutes a sort of jumping board for further study which is effected through a judicious combination of drilling ('imprinting' in memory), explaining difficulties and errors, self-evaluation and training the pupils to be alert while identifying and applying rules. Learning techniques and devices are interchanged all the time (learning games with realistic questions, mathematical calculations with a practical application on paper). In order not to alarm the pupils, supervision is conducted inconspicuously by evaluating through clarification, by correcting first impressions 'on second thoughts', and by getting the pupils to use acquired knowledge and skills in new situations.

This innovative approach results not only in the pupils' improved perception of knowledge, but also in an appreciable gain in lesson time.

Its success, in my opinion, hinges upon the teacher's strikingly sympathetic attitude to the pupil as an individual in his own right. The teacher's main concerns are to ward off slips and errors, to fortify self-confidence, to make the pupils enjoy learning and to instil in them perseverance.

T.P. Komarova, a Siberian schoolteacher and Hero of Socialist Labour, works in an entirely different educational setting. Her school consists of undersized forms with no more than a dozen pupils in the primary classes. Several forms are taught simultaneously in one small classroom, which presupposes an entirely different selection of methods and an equally particular organization of teaching. The teacher may be giving a lesson to the first, second and third forms at the same time. Thus, while the first form is being taught which words are written with a capital letter, the second is working with a textbook and the third is doing an unsupervised grammar exercise using prompt cards. All three forms are working in a strictly regimented

manner so as not to be in each other's way, even though on three separate curricula.

The country has many small schools with only a few forms and a limited number of pupils being taught by one or two teachers. Such schools tend to engender a somewhat unique mode of teaching which features a striking flexibility and dynamics. Thus, Komarova's efforts are aimed at developing methods whereby the pupils could work on a discovery pattern which is introduced now and then into the teaching process by the teacher taking each class in turn. Under the circumstances, problem-oriented methods simply have to be vivid while concise, and that is precisely what Komarova succeeds in achieving. She concentrates on the development of reasoning and speech power, yet not at the expense of the emotional response and artistic perception of life so characteristic of children. This gifted teacher makes the most of the beautiful rural setting to awaken in the pupils a desire for discovering the secrets and enjoying the aesthetic pleasures of nature.

During out-of-class work a teacher/pupil dialogue is established on the surrounding natural objects and sights in all their various forms. While the teacher explains the dynamics of natural phenomena, pointing out the sequence of natural processes, she uses a wide variety of appropriate terms and expressions which the children are quick to pick up in their stride. Such extramural activities are simply invaluable for the development and enrichment of the children's vocabulary and for their environmental education. The children learn to perceive connections between cause and effect, to compare and classify objects by discerning similarities and differences in them, all this being a good exercise to practise their still developing abilities and, by the same token, a chance to develop their powers of reasoning and speech. Here is an example[5].

While on a hike, the children pass a birch tree. The teacher tells a pupil to try and describe the tree, reminding them all that it is a popular emblem of Russia. All the children join in the ensuing dialogue. They are then guided into composing a collective story, beginning by drawing up a plan. According to this plan, the children are given the assignment of describing other trees, e.g. spruce and fir. The improvised descriptions are then compared, which in turn provokes a discussion which has a beneficial effect on the children's speech patterns. The discussion is directed on to other natural objects and phenomena. Unobtrusively the assignments grow in complexity. The children are invited to retell a story they have read, share their impressions of encounters with adults and their schoolmates. The reasoning and speech power of the pupils is stimulated by evoking familiar situations drawn from everyday life. Oblivious that this is a lesson, the children strike up friendly informal conversations.

As a result, the style of essay writing has also considerably improved. Thus, a school girl named Tanya wrote:

I like to observe nature in winter. It snows day and night. Practically all the houses in the village are snowed under. No bird is in sight. I am afraid they all have died of hunger. I put up a feeding rack but next morning I saw all the crumbs untouched. Every day I clean the snow off the rack. We and the birds are feeling the cold. The wind is singing its incessant song.

One cannot but be struck at an 8-year-old girl being so poetic and subtle in portraying nature. On the other hand, the observations of nature should serve to enrich the pupils' vocabulary. The same purpose may be served by getting the pupils to compose a story by first looking at a picture in class. Developing powers of observation in the pupils serves to develop their reasoning power. Simple, familiar things

may be used as objects for observation and description. However, in the process the teacher must always be on the alert to correct the pupils' errors and guide them in a tactful, unobtrusive manner to discover for themselves the right way to explain a rule, to spell a word, compose a phrase and solve a problem. It is from experiences like these that the teacher proceeds to compile control and decoding cards in a printed form, etc.

The use of cards has also proved expedient in the teaching of grammar. Assignment cards for pupils to correct mistakes follow a step-by-step procedure: (a) read the word; (b) locate the stressed syllable and place an accent over it; (c) locate unstressed vowels; (d) find words of the same root; (e) complete the word by filling in the appropriate vowel.

This Siberian primary teacher has found a clever way to use visual aids as an incentive to read books. The children compare the same plot depicted in two different ways, such as a tale narrated in a book and featured in a set of slides. She teaches the pupils to acquire the habits of careful and patient reading. Once they have mastered these habits and learned to read with correct and meaningful intonation, it is much easier for them to learn other subjects. Reading is alternated with discussing works of art and listening to good music. All this enables the pupils to 'peep behind' the verbal form, to strike the right reading tone and measure. Komarova makes wide use of educational games put together either by the teacher or the pupils.

The pupils' aesthetic development is encouraged by a variety of creative activities conducted on a self-reliant basis, such as essay writing, story composing and in-class theatricals. The teacher always lends a ready ear to the pupils' initiatives and suggestions. Creative writing is fortified by drawings, paper modelling and making costumes of characters from folk tales. Komarova's personal gift for narration and her ability to captivate her audience are a no mean asset in introducing the children to aesthetics.

The originality of this modest village schoolteacher's method is fortified and enlivened by an assortment of self-designed teaching techniques, visual aids, schematic representations, tables, cards and educational toys. She also makes use of light-weight portable blackboards and displays where the pupils can check their work. She has managed to organize teaching so judiciously that every pupil learns on his own, without being pestered by fault-finding remarks and yet all the time feels her friendly helping hand. An individualized and differentiated approach is especially appropriate, as this example illustrates, in a small-school situation.

An important feature of Komarova's classes is the atmosphere she has managed to create, both in class and outside, marked by complete mutual respect and trust. She is a devoted and professionally honest person and always a welcome guest and a personal friend in her pupils' families.

Another village school teacher, N.P. Guzik of the Odessa region (Ukraine), is not only a highly competent chemistry teacher but also an innovator in the field of methodology. He has come up with his own system of methods which are based on personal experience and knowledge of theory, and which is well described by his apt motto 'Teach the pupils to teach themselves'. This principle has found expression in a dynamic system of methods, according to which the number of applied meth-

ods varies depending on a particular teaching aim at a particular teaching stage.

Following Suhomlinski's precepts, Guzik lays stress not only on the content of a lesson, i.e. not only on that which is learned, but rather on the pupil's intellectual effort, on his intellect, which helps the pupil overcome learning problems. His methods and techniques are chiefly aimed at the acquisition of material within the framework of a lesson. Ingeniously identifying the 'theoretical nucleus' of the lesson, he leaves a generous amount of class time for the pupils to acquire knowledge on a self-reliant basis. He gets the pupils to apply newly acquired knowledge at various levels of research-generated methods: by reproduction, analogy and by their own creative initiative. The pupils carry out their assignments as a whole class, in small groups and individually; the assignments consist of playing educational games and quizzes, and defending personal solutions to specific problems.

Also worthy of note is the extra-curricular educational value of Guzik's method serving to develop in the pupil an inquisitive mind, initiative and creative thinking as an outcome of classroom work. In short, he strives to inspire the pupil to learn.

Guzik's book[6], which we will discuss at some length, sheds more light on his methods. He discloses in detail how one can depart from the traditionally accepted methods to conduct a lesson in school, his account invariably including the following components: (a) checking of homework; (b) presenting new material; (c) consolidation and repetition; (d) assigning homework.

Following Erdniev's method of merging teaching units into bigger complexes, Guzik finds it practicable to devote an entire lesson to each task within a traditional lesson. As a result, it is possible to use several teaching methods within the time limits of one lesson, the lesson being wholly devoted to either homework control, or presenting new material, or consolidation and repetition, or assigning homework. Thus, at one lesson, new material is presented in several different ways, which would, for example, include for senior forms a detailed lecture, staging a complex chemical experiment with a subsequent review of findings to substantiate an important theoretical principle, providing a background to the solution with due reference to the history of chemical science and, subsequently, comparing this particular stage in the history of chemistry with the progress of modern chemistry and its application to industry and agriculture. In so doing, the teacher focuses attention on the main ideas, describing them with more precision and repeating the definitions of new concepts. The pupils in the meantime are learning to take notes at a lecture, to assimilate difficult theoretical information and to do so in larger portions. At the same lesson, the pupils are initiated into the techniques of unsupervised study using popular handbooks and scientific journals.

This activity may reemerge as a topic of one of the forthcoming lessons at which the only methods used are those of consolidation and evaluation of acquired material. In that case, a lesson becomes a tutorial, a symposium, a case study or even a conference to substantiate a piece of individual research or some such activity. This configuration of a lesson serves to introduce the pupils to methods commonly practised in colleges and universities as well as in self-education.

Turning to the heritage of the eminent Russian educator Ušinski, who made the remark that the 'teacher should limit himself to helping his pupil overcome the difficulties of learning a chosen subject; never teach, always help learn'[7], Guzik

seeks to develop in all the pupils learning-cognitive initiative, to initiate true co-operation, give timely help to every pupil having difficulty and, last but not least, to present new material in a skilful way in order to reveal its inner logic.

Guzik proposes the following groups of methods for various types of lessons:

1. A general analysis of the given material and the methods used to study it, mostly through the medium of lectures.
2. Tutorials combined with individual work by every pupil.
3. Revision lessons including the organization of knowledge.
4. Interdisciplinary lessons with pupils substantiating their own research.
5. Tutorials using laboratory experimentation.

Thus, a lesson of the first type (involving a general analysis of the given material and the methods of its study) would be subdivided into: (a) an introductory lecture; (b) an analysis of material (teaching proper); (c) conclusion or summing-up (factual analysis and description). The second type of lesson – tutorial and individual work combined – also falls into three components: (a) introduction (presentation of a draft syllabus, organization of work, consultation); (b) teaching proper (implementation of the approved syllabus); (c) evaluation (oral or written test).

In presenting material in bigger portions, the teacher is guided by Davydov's theory of content generalization and makes a transfer of chemical theory to the initial stage of chemistry teaching. With regard to individual aptitudes, pupils are given assignments at three different levels on a descending order of complexity: (a) unsupervised creative activity in a new setting; (b) knowledge reproduction with a subsequent theoretical explanation; (c) knowledge reproduction and carrying out operations according to a model. The level of complexity is left to the pupil's discretion. To consolidate knowledge acquisition, various methods of control and evaluation are carried out on a regular basis. By stressing the acquisition of learning techniques (learning to learn), Guzik adopts a step-by-step familiarization of the pupils with the methods of chemical research, which includes theory, data collection and chemical experimentation. The pupils are given unambiguous instructions on how, for instance, to study the properties of carbon and silicon using the electronic structure theory and to determine the place these elements occupy in Mendeleev's Periodic Table, using a model of atomic structure, and learning the physical and chemical properties of carbon and silicon derivatives. Written instructions have proved helpful for the pupils to perform unsupervised research using a textbook and in carrying out experiments.

Guzik has come up with an original procedure to determine the direction of pupils' study and knowledge application. In this system, broad-based lessons of various types are conducted under appropriate motifs stressing the main direction and purpose. Thus, a tutorial to study aluminium is held under the slogan: 'This metal is destined for a great future. You have before you, my friends, a metal of socialism'. This was stated by Černyševski, the nineteenth-century Russian democratic revolutionary. And accordingly, the problem-oriented question 'Why did Černyševski connect socialism with the use of aluminium?' seeks to emphasize the applied, practical value of scientific data available on aluminium.

The teacher pays much attention to solving important practical problems in a life-like setting. To this end, he organizes role-playing among the pupils. The pupils' interest and awareness are awakened by playing such roles as 'foreman', 'purchasing

clerk', 'laboratory assistant', etc. The team of pupils assigned to a project comes up with a blueprint and then has to justify it.

Another original programme developed by Guzik concerns the pupils' reasoning power, including the acquisition of learning skills and habits, as well as logical abilities. This programme seeks to solve problems introduced by such slogans as: 1. Learning to observe is a way to cognition; 2. Definition and explanation serve to establish regularity; 3. Establishing the existence of regularity; 4. The aim of science is to provide solutions to urgent practical problems. The programme involves various methods and techniques involving the educational substance of chemistry teaching in school. Guzik's experience is just another proof that any improvements to teaching methods which are brought about by teachers should contribute specifically to achieving the goals of compulsory comprehensive secondary education, i.e. to enable all normal children to cope with the school curriculum.

Educators and socially concerned people in general are already familiar with the innovative approach of V.F. Šatalov, a teacher from the city of Donetsk and an instructor on in-service training courses for teachers. His approach to teaching methods for different secondary-school subjects (taught in the fourth to tenth forms) is indeed unconventional. There is no unanimity on his system, which has provoked much controversy. It has aroused interest not only among teachers, educators and methodologists, but also among psychologists. On more than one occasion he has been invited to address national meetings and conferences on education. His methods are undergoing experimental evaluation – in which the innovator himself has a hand – in one of the schools sponsored by the USSR Academy of Pedagogical Sciences. Many teachers have tried to adopt his system or imitate it, but not always with the best of results. The most detailed presentation on his methods may be found in his books[8,9].

The important thing about Šatalov's approach is the restructuring of curriculum material as it appears in the textbook into bigger units (two to five textbook sections per unit). The material is presented graphically in the form of succinct diagrams, symbols and oral descriptions. These schematic representations, to quote Šatalov, include 'key terms'. Moscow schoolteacher Lysenkova, whose contribution to methodology has been referred to earlier, has adopted Šatalov's approach. The key terms here serve to organize reasoning and as mnemonics. The use of key terms is aimed at giving the pupil, as it were, a panoramic view of a considerable portion of theoretical material.

In this instance, the key-term diagrams serve to single out the principal relationships among the various pieces of information. Designed beforehand (by specialist teachers), the key terms are initially introduced during the lesson on an incremental pattern during the teacher's introduction and then used by every pupil as any other visual aid (charts, maps, diagrams, etc.). The key terms are an effective visual aid to draw the pupils' attention to the relationships between facts, examples, principles and concepts. Constructed on the principle of combining abstract and concrete knowledge, the key terms serve as visual aids to differentiate related concepts and use basic methods for their analysis.

When introducing new material, Šatalov goes over the material several times, and gets the pupils to reproduce it each time. By the use of symbolic associations it

should be possible to facilitate the memorization of meaningful content. Šatalov lays stress upon the acquisition of the essentials, definitions, the sequence of discourse and demonstration. Key terms can be put to use also in the initial consolidation of acquired knowledge. They are memorized by the pupils to serve as a fulcrum for further acquisition of knowledge.

The pattern to follow in using key terms is the following: (a) the teacher presents new material; (b) the teacher repeats the newly presented material calling the pupils' attention to the key terms (in the form of wall diagrams); (c) the pupils reproduce key terms in colour in their notebooks; (d) the key terms are memorized, initially using examples; (e) textbook material is learned by heart using the key terms. In short, the use of different key terms varies with varying stages of presentation. It turns out that the use of key terms serves to condense the material to be taught and this economy of time permits a much greater amount of unsupervised classroom work to be done. However, one is more likely to take a cautious view of other examples of initiative by the teacher which may have a distractive influence. It would seem that an insufficient amount of time is allotted to observations experimentation and laboratory work, with the oral presentation being somewhat exaggerated.

It should also be borne in mind that the preparation of key terms is a rather painstaking operation. It is not yet certain if this technique is of value for all the subjects studied within the limits of one school form. It is not easy to find a specialist teacher who can prepare and use key terms with the same skill that he can teach his subject.

One may wonder lest Šatalov's method should interfere with other progressive teaching methods, such as problem orientation and discovery procedures. In the preface to one of Šatalov's books, Kalmykov aptly remarks that problem orientation should not be allowed to overshadow the usefulness of memorization and reproduction in knowledge acquisition, since these latter play a part in encouraging the pupil to do his own creative thinking. Far from trying to overshadow the self-reliance component in teaching, Šatalov seeks to take advantage of reproduction to motivate the pupil to 'discover' new knowledge for himself and therefore his method prescribes quite a few problems of varying difficulty. He encourages the pupils to pick out more complex problems for solution. Indeed, he goes as far as to resort to problem orientation in the form of giving the pupils a chance to work out key terms by themselves, as well as in the form of free discussion and contest-type lessons.

Šatalov's procedure offers an opportunity for every pupil to check the knowledge of his peers, thus presupposing a combination of evaluation and self-evaluation in an atmosphere of friendly teamwork.

His calculations show that an average pupil per average school-day spends two minutes of classtime in active speech. By introducing various techniques of repetition he has been able to extend this average to six minutes, thus to no mean degree contributing to the development of pupils' powers of expression. He has come up with a host of knowledge-control techniques (in a loud or soft voice, with the aid of a tape-recorder, mutual verification in pairs, or having seniors confirm the answers of juniors). Thus, a pupil writes down the solution of a problem only after it has been collectively solved orally. The solutions may be confirmed in various ways. Take,

for instance, an 'inverted relay-race approach', with the first solver's answer being confirmed by the teacher and each consecutive solver's answer being verified by the pupil who has solved the preceding problem. Alternatively, the first group of pupils to solve a problem are allowed to confirm the answers of all the rest. In a third technique, the class is divided into five sections corresponding to the rows of desks, and the confirmation of answers proceeds along the rows. This activity is preceded by an analysis at the blackboard of between three and five problems of varying difficulty.

Whatever activity is in progress, mutual aid is encouraged. Any pupil may ask for another's help. The teacher channels aid to those who need it most. This has been dubbed by Šatalov the 'task-force' approach. The results are displayed for all to see; every pupil's performance is recorded on a 'knowledge' card for public display. To record the degree of mutual aid there are 'mutual control' cards. The acquisition of every unit of theoretical knowledge is always followed by problem-oriented exercises. During problem-selection lessons any pupil is free to choose a problem for solution no matter how difficult. These techniques contribute to the development of will-power and perseverance in achieving goals.

Among other teaching techniques, Shatalov resorts to an educational game whereby the pupils are unobtrusively guided towards a scientific 'discovery'. For example, in a geography lesson to study isotherms, the teacher begins by saying that isotherms do not coincide with latitude. Pointing out the isotherms of Eurasia, which are published daily in the newspaper *Izvestia*, the teacher assigns the pupils to record temperature fluctuations for a whole week along the line Paris–Prague–Kiev–Irkutsk. The pupils do this with enthusiasm. In so doing, they are guided to 'discover' why different geographical points have different temperatures, even though they are situated almost on the same latitude. Thus, in studying a particular problem in the form of a game, the pupils learn which factors, besides latitude, determine the climate, such as the proximity of the ocean, warm and cold currents, etc. In short, the teacher departs from the monotonous oral discourse involving plotting graphs and abstract declarations about the causes of climatic differences and suggests that the pupils themselves should make a study of all these problems, imagine the related phenomena on a global scale and, last but not least, compare the parameters for the place they live in with the parameters for other places.

Summing up Šatalov's method, one can note the division of material into larger units, the use of key terms, a lively pace of teaching, a differentiated control over acquisition and a higher dosage of practical exercises. He cautions against too much pragmatism and stresses the importance of theory. First comes theory and only then the acquisition of skills necessary for its application. Prior to every exercise, the main concepts and theories pertaining to the matter in hand and briefly surveyed. Progression in complexity has to be gradual with a wide variety of problems being solved both at home and in class.

Šatalov never punishes his pupils for errors, merely holding out to them the prospect of getting progressively higher marks. All this contributes to the conscious acquisition and subsequent consolidation of knowledge resulting from learning, exercises, application and learning to apply knowledge in constantly variable settings.

It should be mentioned yet again that success depends essentially on the teacher's

personality. Šatalov is a highly emotional individual who knows how to tell a story, how to probe deep into the soul of every pupil. His active, enthusiastic and boisterous personality, and the lively tempo of his lessons cannot but provide a powerful stimulus for the pupil to act likewise, to learn to think as clearly, to appreciate art and literature as profoundly as his teacher does – a very rare teacher indeed. He is as devoted to his profession and engaged in constant search for new and better methods as very few men are. He believes that his method motivates the pupils to overcome any obstacles in their way, serves to bolster up the poor achiever and open up new vistas before the good one. And indeed, every one of his pupils feels the 'joy of learning', to use Suhomlinski'js phrase.

If one considers school work in terms of statistical averages one is likely to come across quite a few difficulties and shortcomings. Their analysis, the identification of their causes and their contrast with the most successful experiences should lead, in the final analysis, to dramatic improvements of education in school and outside. Now that we have reviewed the situation in brief it is incumbent upon us to orient the teacher in his effort to make optimum use of the available teaching methods. The accompanying table highlights the main areas of emphasis in this respect.

Recommendations for teachers

1. Put an end to haphazard selection of teaching methods and acquire the skill to substantiate a preference for a particular method, basing this choice on the aim and content of each particular lesson, to achieve the high level of learning initiative in the pupils concomitant with the use of an adequate method; lay greater stress upon the motivational capacity of methods.
2. Renounce the conventional oral presentation as a pattern monotonously followed from lesson to lesson and which is no better than a mere reproduction of what the textbook says; update the main ideas and concepts, referring all the time to the evolution of scientific knowledge and avoiding the presentation of 'ready-made' knowledge to the pupils.
3. Seek to achieve an adequate level of activity both on the part of the teacher and the pupil, ensuring that the teacher's activity does not hold back the pupil's activity, since the animation of teaching methods concerns both sides of the educative process: teaching and learning.
4. Continue to develop techniques to establish teacher/pupil feedback; be more on the alert to the pupils' initial faults and errors when perceiving material; monitor the acquisition of material at every stage; ward off errors and mistakes; overcome difficulties in teaching and learn to establish the relationships between the main principles; identify the essentials and how to apply the acquired knowledge in different situations.
5. Pay more attention to such individual traits of pupils as the level of nervous activity, the characteristics of their psychical, physical and intellectual backgrounds; learn to balance collective in-class work with an individual approach in the application of teaching methods, to the exclusion of excessive egalitarianism, always keeping in mind that the acquisition of knowledge by every pupil is a strictly individual process.

6. Establish the relationships between teaching methods and types of organization – by class, group or pupil; take optimum advantage of work in groups of four to six pupils when carrying out assignments in the laboratory, etc.; this makes for close collaboration between pupils and provides more possibilities for mutual aid and a better control of the results achieved by every pupil.
7. Broaden the scope of unsupervised activities aimed at the acquisition of new material; this approach should not be limited to study; progressively increase the difficulty of unsupervised assignments by creating the need for the definition and explanation of abstract material capable of application in a wide variety of conditions.
8. Develop in the pupil skills and study habits with a view to the progressive acquisition of new knowledge (techniques of information retrieval from various sources, the choice of the appropriate experiment, designing and modelling, recording and reproducing the results, planning and forecasting of results, coming to a conclusion); develop in the pupil the mastery of abilities and study habits, and teach him to make the best use of them.
9. Go beyond the narrow limits in the use of teaching aids, especially audio-visual (used exclusively to illustrate acquired knowledge), and thus broaden the possibilities of these aids as a source of information in their own right; seek the interaction of all the available teaching methods and techniques, an interaction co-ordinated with the logic, content and structure of the given lesson.
10. Broaden the array of teaching methods and techniques to be used for the testing and consolidation of material in hand; avoid the practice of conventional repetition or drilling, and always inject the elemeats of novelty into the teaching material and pupils' activity; seek to combine the memorization of knowledge, its permanent and conscious acquisition with the development in the pupils of the capacity for gaining and applying knowledge by themselves.

REFERENCES

1. Zverev, I.D. *Teorija i praktika metodov obučenija v sovremennyh uslovijah obščeobrazovatee'noj školy.* Moskva, APN SSSR, 1975.
2. Zverev, I.D. *Metody obučenija v sovremennoj škole. Narodnoe obrazovanie* (Moskva), no. 3, mart 1976, p. 116-127.
3. Lysenkova, S.N. *Kogda legko učit'sja: iz opyta raboty učitelja načal'nyh klassov školy No. 587 Moskvy.* Moskva, Pedagogika, 1981. 144 p.
4. Ibid., p. 20.
5. Suvorova, G.F. *Sel'skaja učitel'nica: opyt Geroja Socialističeskogo Truda T.P. Komarovoj.* Moskva, Pedagogika, 1980.
6. Guzik, N.P. *Učit učit'sja: iz opyta raboty učitelja himii.* Moskva, Pedagogika, 1981.
7. Ušinskij, K.D. Trud v ego psihologičeskom i vospitatel'nom značenii. *In: Sobranie sočinenij.* Moskva, APN RSFSR, 1948, t. 2, p. 358.
8. Šatalov, V.F. *Kuda i kak isčezli trojki.* Moskva, Pedagogika, 1979. 136 p.
9. Šatalov, V.F. *Pedagogičeskaja proza.* Moskva, Pedagogika, 1980.

Conclusion

Highly complex research work, aimed at improving the content of education and teaching methods in the Soviet school, has been conducted over the past ten years in conformity with the guidelines contained in the appropriate resolutions of Soviet Communist Party congresses and in Party and Government decisions on the further development of public education and the upbringing of the younger generation in the spirit of communism. The curricula for almost every subject have been revised. The teaching of sciences in school now rests on a more solid foundation, the system of educational objectives has been considerably improved and the acquisition of knowledge is now more carefully and consistently combined with the acquisition of work and study habits and skills.

The content of formal education is now more carefully substantiated in terms of educational theory and science in general, which has involved the optimum combination of the components to teach each particular subject. The interaction of all these factors naturally contributes to an improvement in the acquisition of knowledge in school. The content of education is a tightly organized combination of the ideological, political and moral realms of knowledge as well as ethical and aesthetic ideals. There is no doubt that the newly revised content of formal education has made it much easier for schoolchildren to grasp the fundamentals of science. An equally important role in upbringing is played by socio-historic subjects and other humanities. Through the findings of educational research the Soviet pupils are now successfully initiated into the study of Marxist-Leninist classics, biographies of outstanding Marxist-Leninists, the Soviet Constitution, Party and Government decisions, as well as the documents of the international communist and workers' movements.

The content and methods of education serve to achieve the goals of modern formal education. The system of concepts underlying the outlook and convictions prevailing in society are of fundamental importance, since these concepts also serve to substantiate the development in the pupils of the capacity to acquire on their own the methods of accumulating and applying knowledge in school, at work and at home, which obviously helps bridge the gap between the study of science and vocational training.

Another beneficial result of recent revisions is the increasing attention being paid to the problem of combining instruction with upbringing and personality development. This concept of education in its broader sense involves the methods of cognition, systematic techniques of intellectual work such as analysis and synthesis, the comparison of objects and phenomena in the environment, the verification of

suppositions and their definition, the identification of the core of a problem, and a judicious use of scientific principles and methods. In order to present a successful combination of content and methods, curricula and textbooks should be based on the following guidelines: a clearer presentation of the basic concepts; greater stress upon the logical presentation and theoretical explanation of the facts; the introduction of theoretical concepts early on in the curriculum for a particular subject; greater emphasis on deduction rather than induction in presenting material in the classroom; greater stress on polytechnical knowledge of use in modern industrial production; the concision of knowledge through integration and summary; the establishment of interdisciplinary connections; and a reduction of auxiliary material in favour of an increase in basic knowledge. Secondary education, which has recently become universal and compulsory, has come in for a greater share of attention in the revision of curricula.

The results already achieved in the improvement of educational content and teaching methods have become possible owing to a better understanding of the whole concept of educational theory and day-to-day scholastic activities. Considerable progress has been made in the development of the theoretical foundations of formal education. The following criteria to select educational material and methods to study it have been advanced: formal education, communist upbringing and the pupil's personality development are conceived as a unity; identification of the scientific bases of a system of knowledge; greater attention to the cognitive abilities of pupils; a more rational distribution of teaching time according to the material to be taught; and an assessment of the physical and material equipment available for formal education.

A comprehensive study is now being undertaken to examine the conditions under which the teacher and pupils work, the age and individual profile of schoolchildren and the programme of learning. Teachers now are better trained; school equipment and teaching aids have been improved; the management of formal education has kept pace with these developments. Every factor influencing formal education is now being studied separately with a view to the general improvement of school work as a whole.

A vast body of educational studies and teachers' experience has been collected relating to the stimulation of teaching methods in order to make them more appropriate to the new content of education and to keep pace with contemporary realities. Improvements have been introduced into the application, combination and also into the substantiation of method selection. The basic relationships of methods have been identified both with regard to the content and the means of education, as a result of which the narrow-minded approach presupposing a linear subordination of these categories to the process of education has been overcome.

Both theorists and teachers have been working to identify the relationship between the content and methods of education and the organization of pupils' learning activities. Special attention has been given to the problem of rationalizing the daily programme and the optimum arrangement of in-school activities in accordance with educational and health standards. Greater attention than before is being paid to such factors as the time element, the degree of difficulty of material and the pupils' need for interesting and creative assignments. Special attention has been

given to the successful performance of every pupil, to the development in every pupil of a thirst for knowledge and perseverance, as well as reinforcing those motives which are apt to engender the desire for education and self-education.

The results of research on the content and methods of education have served to reinforce both educational science and teaching. At the same time, today we are confronted with new problems, and have to overcome the difficulties and rectify the shortcomings which inevitably occur at each step forward of formal education. In forthcoming research on curricular philosophy and teaching, it is proposed to clarify and put into practice the concept of an optimum combination of all the major components of educational content in teaching every subject. These goals are to be achieved through the strengthening of the ties between general theory and particular methodological approaches.

It is necessary to demonstrate more clearly the relationship between different subjects in order to achieve their greater integration in the context of education as a whole. It is also necessary to pay greater attention to the linkages between humanities and the natural and exact sciences, with a view to giving the pupils an integrated image of the world expressed as 'nature–society–man'. This concept serves as a guide in developing teaching methods based on interdisciplinarity.

A still greater effort has to be devoted to improve not only the standard textbooks but all the auxiliary literature the pupils are likely to use. This enterprise has already been set in motion by the publication of top-quality textbooks, some of which have been awarded national prizes.

Educationists are yet to come up with a comprehensive classification of teaching methods based on classroom experience and described from the viewpoint of both general and particular methodology. They should pay more attention to the new possibilities of improving and developing teaching methods by drawing upon schoolteachers' innovative experiences. Of particular importance is the latters' contribution to the search for new techniques to develop cognitive interest in every pupil and to reinforce the upbringing component in teaching methods. However, this has not been at the expense of purely instructional knowledge-imparting components.

In exploring prospects for the school of the future, the central problems are still those of the structure and content of education and teaching methods. In this connection, there is a need to furnish a more profound basis for the compilation of syllabuses. Scientific forecasts concerning the content of education for the school of the future may focus, for instance, on the improvement of structure either of each individual school subject or for the school curriculum as a whole. In so doing, the forecasters should not yield to the temptation of trying to represent all the trends of any given science to the same degree. Changes in the content of school subjects, their order of study and the introduction of schooling from the age of 6 (now being tried out experimentally) are still awaiting proper definition; and, besides, to effect a transformation on such a scale, the entire structural content of education and teaching methods has to be overhauled and an entirely novel approach adopted to teaching, learning, health and socio-economic problems.

Glossary of educational terms

This glossary has been compiled on the basis of the appendix to the book by **Zverev, I.D., ed**, *Problemy metodiki obučenija biologii.* Moscow, Pedagogika, 1978. 320p. Where definitions include phrases appearing elsewhere in the glossary, they have been printed in italic type.

Active study method. The involvement of the pupils in an educational activity concerned with *communist upbringing*, the acquisition of knowledge, useful skills and habits, the development of personal qualities (observation, imagination, skilfulness, industriousness), and the inculcation of initiative and *self-reliance.*

Aesthetic education. An essential component of *communist upbringing*, aesthetic education is defined as the development of appreciation of works of art and everyday phenomena, as well as the encouragement of good taste among creative people.

Atheistic upbringing. The acquisition of an objective, materialist view of the world where religion is tolerated as one pattern of social behaviour.

Attitude. Deliberate behaviour which expresses itself as the desire to learn about the surrounding world.

Audio-visual demonstration. A *teaching method* where slides, films and television broadcasts are shown to pupils for a specific purpose.

Cognitive interest. A lively trait of the personality, a quest for knowledge, an active desire to learn about all fields of knowledge, natural phenomena, societies and schools of thought.

Common cognitive and practical activities. The more or less unified activity of all the pupils in a particular class working on a common assignment under the teacher's supervision.

Communist ideology. A view of objective reality and the laws governing it acquired through *communist upbringing*, education and personality development based on dialectical materialism; particular attitudes to natural phenomena, society and ways of thought arise through the application of a dialectical approach to everyday reality; a system of views which fosters conscious and active involvement of the individual in the construction of a communist society, which in turn presupposes opposition to bourgeois ideology and religion.

Communist upbringing. Education using an *interdisciplinary approach* to attain the all-round, harmonious development of the individual in the spirit of *communist ideology.* Communist upbringing combines *ideological and political education, work-oriented education,* and *moral upbringing.*

Convictions. A system of well-defined personal requirements which cause a person to act in conformity with firm views, principles, ideals and attitudes.

Definition. A logical operation to discover general characteristics (in the case of an empirical concept) or laws (in the case of a theoretical concept). An evolved system of definitions constitutes a theory.

Empirical concept. Knowledge of the general, basic, observed properties of reality obtained through the analysis, synthesis, systematization and classification of data

which have been obtained by observation and experiment.

Environmental education. Instruction on the relationship 'society-man-nature' with the objective of inculcating a sense of civic responsibility for environmental conservation in every individual.

Excursion. An organized form of teaching outside the school premises (in the countryside, at a factory, at a museum or in the *school experimental plot*) in which either the whole class or a group of pupils participate. For instance, on an excursion to a factory, pupils are introduced to various trades, made familiar with machinery and equipment, the operation of machines and tools, the organization of production, and get a general idea of scientific knowledge applied to industry.

Experiment. The scientific or educational study of a phenomenon in precisely controlled conditions enabling observations to be made and the circumstances to be replicated whenever necessary.

Experimental problem. A problem depending for solution on an experiment. Experimental problems may have the objective of drawing a conclusion, or developing, confirming or disproving a *hypothesis*.

Extra-curricular studies. A form of sharing lessons with a group of pupils from one or several neighbouring schools who are studying specially-approved subjects of their own choice not usually provided in typical classes. Besides extra-curricular groups to study subjects in greater depth, there are groups to study subjects outside the curriculum. Extra-curricular studies may be oriented towards a preferred future vocation.

Extra-curricular work-oriented tutorials. A form of vocational training mainly intended to introduce pupils to various jobs, thus facilitating their choice of vocation. Attendance is optional from the seventh form onwards, studies being conducted on a specially approved curriculum adapted to local conditions.

Human ecology. An interdisciplinary science concerned with the relationship of human society to nature.

Humanization of natural science. The process of integrating knowledge about nature, society and man.

Hypothesis. A statement that takes known facts into account but for which there is no direct supporting evidence; to solve a *problem situation*, a probability.

Ideological and political education. The acquirement of *communist ideology*, i.e. a blend of knowledge, *convictions* and practical initiative acquired through a profound study of Marxism-Leninism, the policies of the Government and Communist Party of the USSR, and an equally profound desire to find a solution to the contemporary issues of communist society.

Industrial ecology. The introduction of technology which results in either the complete or partial eradication of environmental contamination (wasteless technology).

Intellectual skills. Properly mastered and consolidated teaching/learning techniques and abilities (capacity for analysis, synthesis, comparison, consolidation, definition, etc.).

Interdisciplinary approach. A system of linkages between school subjects (disciplines) based on the *principle of complementarity* which enables their co-ordination and integration to serve the purposes of education.

International education. A process, inseparable from *patriotic upbringing*, to develop and enhance individual feelings of friendship and respect for the working people of all nations, as well as profound *convictions* on the necessity for international solidarity.

Learning model. A visual (often three-dimensional) aid used to express the structure or function of all or part of an object on a lifelike, magnified or reduced scale. Models may be working or non-working; it may or may not be possible to dismantle them.

Lecture. A teaching method in the form of a teacher's monologue which is constructed along strictly logical lines (introduction, main theme, conclusion).

Lesson. The basic unit of organization of the educative process during which the concepts of curricular material are imparted according to a consistent pattern through carefully selected methods oriented not only to the acquisition of knowledge, but also to upbringing and personality development, including the acquisition of *communist ideology* and development of the intellect. Depending on the teaching aim and the emphasis the material requires in the educational programme, lessons may take several forms: film-shows; television broadcasts; introductory; presentation of new material; laboratory work; summing up; seminar; tutorial; etc.

Memorization. The reliable retention of instructional material in the memory.

Mental hypothesizing. A research method during which *principles, hypotheses* and other universal scientific concepts are substantiated, visualized and connected to the empirical data available.

Modelling. Carrying out research on an object by studying *learning models* of it, which implies studying and understanding its design and construction.

Moral education. The formation of awareness and behaviour in conformity with communist ethical standards.

Motivation. Personality's inner drive towards an action for the purpose of satisfying a need.

Optional activities. A system under which the pupil is offered a choice of optional subjects and classes to study curricular subjects in a more profound manner.

Out-of-class activities. A form of organizing pupils' out-of-class voluntary activities (sometimes under the teacher's guidance) for the purposes of upbringing, stimulation of interest, encouraging creative *self-reliance*, increasing theoretical and applied knowledge, as well as for social activities. Out-of-class activities can be individual (observation of nature, making visual aids, précis writing, collection/gathering) or collective (visits and *excursions*, social events, voluntary work on state and collective farms, etc.).

Patriotic upbringing. A process, inseparable from *international education*, to develop in the individual feelings of honour and devotion to his country, interest in national history and achievements, and readiness to defend the good of his people and that of mankind.

Physical education. An essential component of the comprehensive system of *communist upbringing* aimed at improved human health and the harmonious development of the body.

Polytechnical skills. Universal or general qualifications which are applicable to several major industries and which provide a basis for the development of professional skills of a more specialized nature.

Practical activity. A method of studying objects through their examination and reconstitution.

Practice. The activity of a person or society as a whole serving to put natural and social resources to use; the mode of existence of man and society.

Principle. A fundamental proposition; a premise; a point of departure in the study and presentation of a scientific *theory*; the logical foundation for the organization of knowledge. A principle forms part of *scientific laws*.

Principle of causality. A proposition concerning objectivity, universality, the direct relationships between phenomena, one of which (cause) is apt, under appropriate conditions, to engender another (effect).

Principle of complementarity. A *principle* substantiating the synthesis of many different theories, doctrines, concepts and facts underlying intra- and interdisciplinary relations.

Principle of systems. A method to deal with the theoretical study of both objects and systems (identifying the elements and relationships, studying the mechanism of functions, internal organization and development).

Problem. Knowledge of the unknown; the justification of learning; an essential link and stage in the development of a theory,

in the conversion of empirical to theoretical knowledge.

Problem situation. An uncertainty in practical or theoretical activity resulting from a confrontation of kindred, but mutually contradictory, facts, concepts, laws, theories, standards or principles; a situation in which the hitherto effective ways and means of activity are no longer sufficient to attain new goals.

Pupils' productive work. A kind of socially-useful work of economic benefit to society – besides having educational value.

Pupils' productive work team. One of the most popular forms in the USSR of organizing the vocational education of pupils attending general education schools and introducing them to productive work.

Pupils' socially useful work. Work and social activities carried out by pupils and directed towards satisfying social needs. It is conceived as a contribution to *communist upbringing* in the sphere of comprehensive personality development and attitudes to work.

School experimental plot. A specially prepared garden plot which serves to familiarize pupils with local farming practices within the biology and vocational training courses. The pupils use the plot to carry out biological and agricultural experiments and similar activities.

Scientific fact. Either an isolated fact or a sequence of empirical data on the properties and relationships between objects and processes; it is obtained through the analysis of data gathered during observation and experiment.

Scientific laws. A system of stable, recurrent connections between phenomena expressed in theoretical terms. They become *principles* when used for organizing data and explaining facts.

Scientific methods. Ways and means of learning about reality through the study of concrete problems. They include observation, experimentation, *modelling*, *mental hypothesizing*, comparison, description, theoretical study, etc.

Self-reliance. The ability to work on one's own, to form personal judgements and to introduce innovative and creative elements into one's work.

Spatial vision. The capacity to express graphicaly objects and phenomena which have been retained in the memory in a visual form, i.e. without the objects and phenomena being present.

Teaching methods. A system of teacher/pupil interactions to achieve educational goals.

Teaching technique. A component of *teaching methods* which is selected according to the particular aim of teaching and the means available.

Theoretical concept. A form of reasoning reflecting in an abbreviated form the law governing the functioning or development of a system.

Theoretical knowledge. Knowledge of the basic relationships and laws of objects and processes; the faithful reproduction of reality; a concrete and objective basis for man's practical activities.

Theory. A coherent system of laws serving to describe and explain any combination of phenomena proceeding from a certain unique explicative principle.

Unsupervised work. A system of methods to organize an educational process whereby the teacher refrains from guiding or influencing the pupils' cognitive initiative in any direct way.

Visual teaching aids. Natural objects or their images used to serve educational objectives.

Work-oriented education. A purposeful process to develop in the pupil an attitude to work based on *communist upbringing*, industriousness, readiness to work creatively for the good of all, a sense of responsibility for one's work, honesty and ingenuity at work.

The importance assumed by the educational sciences in the USSR since the Second World War, together with the scope of the research conducted by the Academy of Pedagogical Sciences in Moscow and its network of Institutes spread over the different Republics of the Union, give this monograph exemplary value by showing how, in an education system based on the multiplicity of cultures, on the one hand, and the unity of goals on the other, all the resources of the human sciences can be brought into play for the ever increasing improvement of the modes of education and training of man.

Professor I.D. Zverev's analysis of teaching methods in this volume gives the reader a vivid grasp of the foundations of the very dynamics of the education system in the USSR: the dialectic of ends and means.

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